

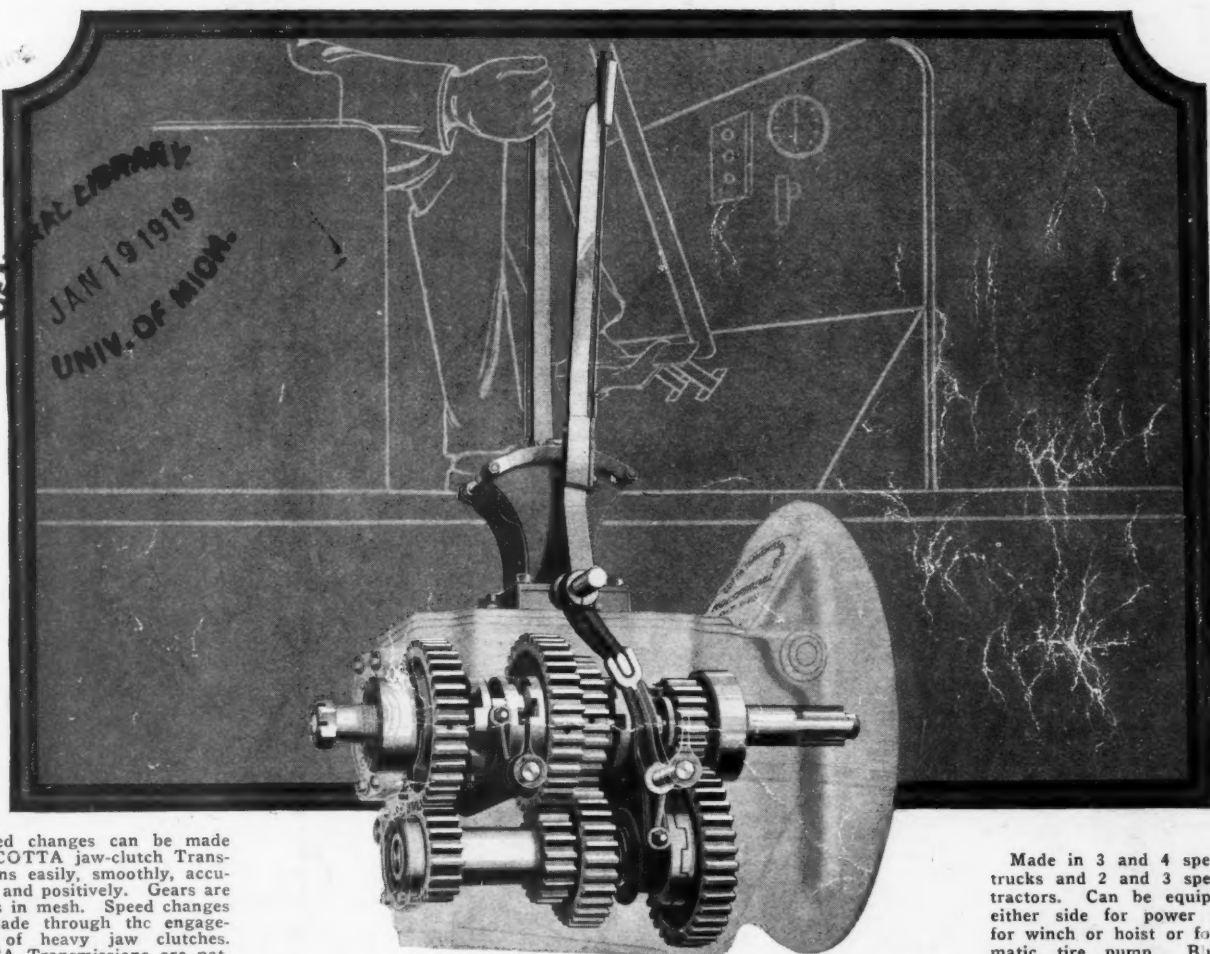
AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol XLII
Number 1

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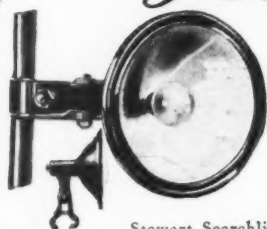
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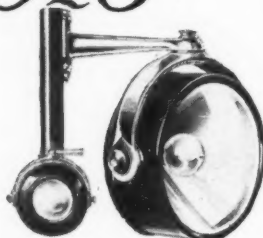
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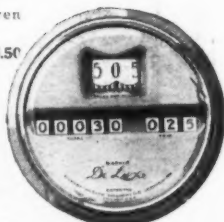
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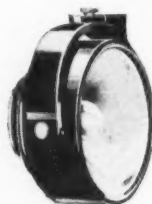
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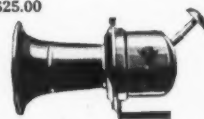
Stewart Searchlight
Model 139-C - - \$6.50



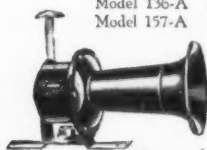
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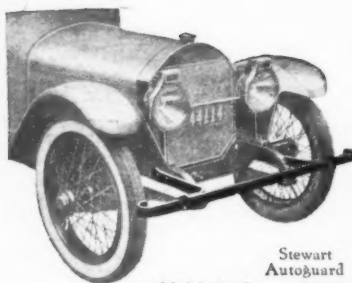
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Vols 1239-90
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AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

VOL. XLII

NEW YORK—THURSDAY, JANUARY 1, 1920—CHICAGO

No. 1

First Post War Aircraft Exhibition Held in France

President Poincare opens the first aircraft exhibition in France since the war. Many new types of machines exhibited; passenger cars play a prominent part. Commercial element dominates the show, the military being only slightly in evidence

By W. F. Bradley

Paris, Dec. 21.

THE importance which is attached to aerial navigation by the French Government is reflected by the fact that President Poincare opened the first Aircraft Exhibition held here since the war. Marshals Foch and Petain were also present. The show is being held in the Grand Palais, where upward of 400 exhibitors are staging their products. French manufacturers predominate, but Italy and England also have creditable exhibits. The United States unfortunately is not represented.

The opening of the show was marred by the announcement of the death of Captain Jack Alcock, the British aviator who was the first man to make a trans-Atlantic flight without stop. He was killed while flying a machine from London to Paris, where the machine was to be exhibited.

The show is purely commercial in character, the military element being slight. An outstanding feature is the large number of big planes for regular passenger and freight service for various European routes. These planes are capable of carrying, in addition to the pilot and wireless operator, 15 passengers, some freight and mails. A machine fitted with two Napier Lion engines will go into regular service next year. Bleriot exhibits

a 28 passenger biplane fitted with four Hispano-Suiza engines of 300 h.p. each. This machine has a central fuselage divided into upper tower cabins, the pilot being stationed in the upper forward portion of the fuselage. The four engines are built into the wings, to the left and right of the main fuselage. A fine stream line effect is obtained for the entire machine which weighs $3\frac{1}{2}$ tons and has showed a speed of 100 m. p. h. It is, however, not yet ready for regular service.

Caudron exhibits an immense biplane having accommodations for 30 passengers. This machine is propelled by three Salmson radial engines, one mounted at the front of the main fuselage and the other two in nacelles, to the left and right midway between the wings. Farman shows the Goliath 12-passenger plane fitted with two Salmson engines. This machine has a span of 92 ft., a chord of 9 ft. 10 in. and a useful load capacity of 2 tons.

Italy is represented by a Caproni bombing triplane fitted with three Fiat engines of 200 h.p. each. This, however, is not the latest machine of its type, as Caproni is building a 1000 h.p. plane designed for carrying 100 passengers. Railroad restrictions in Italy made it difficult to get the Italian exhibits to the show in time. Fiat shows a long range, high-speed machine for carrying

two passengers and 400 lb. freight. This machine can remain in the air for 19 hours and cover a distance of 2500 miles without replenishing supplies.

The passenger planes are well thought out with a view to providing the best position for the pilot and insuring comfort for the passengers. In every case it is recognized that the passengers must be well protected and that the pilot must be out in the open where he can have an uninterrupted view ahead. In planes having a single fuselage and an engine in front, this object is generally attained by placing the pilot immediately behind the engine and completely enclosing the passengers in the fuselage, the latter often being provided with a raised upper structure with windows, forming a light, commodious cabin.

While much attention is being devoted to giant planes, manufacturers are also making an appeal to the individual by the production of small, economical single seaters. A typical example of the smallest of these is the Demarkay biplane which has a span of only 13 ft. and a length of 12 ft. 6. in., the total weight in flying trim, including a twin cylinder horizontal air cooled engine, being only 220 lb. This machine sells complete at a price which at the current rate of exchange is about equal to \$1,000.

Lewis Clement shows a triplane having an 18 ft. span and a 3-cylinder, 30 h. p. engine. It weighs 600 lb. empty. Farman is specializing in a sporting type biplane with a 50 h. p. Rhone engine. This machine carries two passengers and a useful load of 400 lb. and its price is \$1,500 on the basis of the present exchange rate. It is claimed that the operating cost figures out at about 3 cents per mile.

STEEL CONSTRUCTION

Steel construction in airplanes is making considerable headway. Breguet and Voisin are the leaders in this direction. These firms are manufacturing all but the wing ribs of steel. Other manufacturers are using metals for the complete machine, including wings, notably a British firm, Bourton & Paul. Potz builds the wings entirely of duralumin.

Engine powers have increased enormously, the most powerful engine at present in production being the Fiat 12-cylinder, 700 h. p. Other engines of higher power are under development, and there is talk of single units running as high as 1200 h. p. Automobile type, water cooled engines predominate, but there is as yet no crystallization of design. Freak creations have disappeared, but rotary and radial engines with air cooled cylinders are prominent, particularly in sizes of 100 h. p. Fiat has produced two new engines, one being a geared down V twelve with steel cylinders, welded-on jackets and intake manifolds inside the jackets. The valve operating gears in the center are entirely closed in, and the exhaust, carbureters and magnetos are on the outside of the cylinder blocks. This arrangement of accessories is now insisted upon by the French military authorities, in order to diminish fire risks and increase accessibility. Nothing is carried in the angle of the V.

The other new Fiat is a 9 cylinder, water cooled, radial engine with cylinders made from steel forgings, having the jackets welded on and the intake pipes, com-

posed of steel tubing, welded inside the jackets, so that there is no visible intake manifold and the mixture is heated on its way from the carbureter to the valve parts. This engine is fitted with four valves in the head, which are operated by a single push rod and close by a single laminated spring. With cylinder dimensions of 130 m. m. bore and 150 m. m. stroke, the output is 320 h. p. and the weight with a supply of cooling water, 620 lb.

THE PEUGEOT

Peugeot has produced a 16-cylinder X type engine of the Jouffret system, having a bore of 130 and a stroke of 170 m. m. The cylinders are made of steel and there is a common sheet aluminum jacket for each set of four. Four valves are located in each cylinder head and are operated through an overhead camshaft. The feature of this engine is the straight intake manifold for each group of four cylinders, which is water jacketed. There are two fuel jets in the end of each manifold branch, and air also is admitted from the two ends, so that the manifold forms the mixing chamber.

Another Peugeot engine is a 12-cylinder V with 160 by 170 m. m. cylinders. This is an aluminum construction with steel cylinder lines, overhead valves and other features reminding of the Hispano-Suiza, but rockets are inserted between the cams and the valves. The carbureters are mounted on the outside of the engine and manifolds pass through the valve gear housing to the inlet valves on the inside of the V.

Dietrich has a new 1200 h. p. water cooled V type engine with steel cylinders and steel welded-on jackets. This engine has the camshaft in the crankcase and operates the valves through push rods. Salmson has continued the radial type water cooled engine but added another engine on the same general lines with steel cylinders and aluminum fins for air cooling.

Gnome shows a new 60 h. p. 9-cylinder, 84x106 m. m. rotary engine with several departures from previous practice. The cylinders are not held down by studs and nuts. Both valves are in the head and are operated through a single rocker arm. Gas is delivered to the cylinders through an external intake manifold, one branch to each cylinder head. The hollow crankshaft is used for cooling the engine oil. A closed circuit lubrication system is employed and the oil consumption has consequently been considerably reduced.

Buggatti has connected four of his engines to drive a single shaft carrying a propeller. If any one of the engines stops it is automatically disengaged by a clutch mechanism, and the propeller is driven by three engines. Farman has produced his own aircraft engine, this being an eight cylinder, water cooled, V type with valves in the head and a camshaft in the crankcase. It develops 200 h. p. at 1800 r. p. m. and operates the propeller at 1050 r. p. m. Including an electric lighting and starting set, the weight is 700 lb. This engine was designed to be entered in the French Government competition next year. Special attention was paid to the ability to run continuously in the air and provision is made for carrying a large quantity of oil which can be heated or cooled as desired. Even the whole engine can be heated when operating at extremely low temperatures.

The British Motorcycle Show

The Olympia exhibition was a surprising event, considered either from an engineering or a public interest standpoint. The high price of gasoline and high prices of cars has made the cycle in great demand in Europe, where it is used for many purposes for which a car is used in this country. Mr. Bourdon has written an instructive and interesting account of the show

By M. W. Bourdon

VERY pronounced tendencies are exhibited in certain directions at the fifth International Motor Cycle Show which opened at Olympia on Nov. 24, one week after the closing of the automobile show. Seventy-six different makes of motor cycles of all descriptions are exhibited, in addition to five examples of British runabouts which are really two-seated light cars with three wheels—two steerers in front and one driving wheel behind. America has four representatives on three stands, namely, Henderson, Harley-Davidson, Indian and Excelsior. Only one Belgian make appears, i. e., F. N., the remainder being purely British productions.

In regard to engines, these may be divided into six classes:

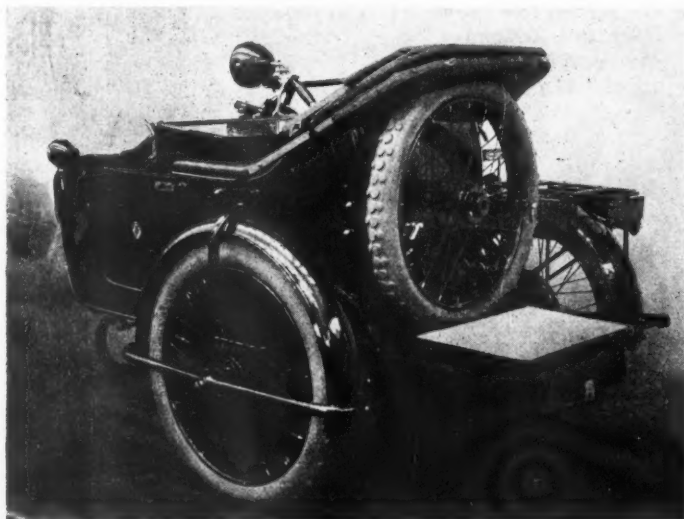
- (1) Two cycle, single cylinder.
- (2) Two cycle, two cylinder.
- (3) Four cycle, single cylinder.
- (4) Four cycle, twin cylinder opposed.
- (5) Four cycle, twin Vee cylinder.
- (6) Four cycle, four cylinder vertical.

Since 1914 there has been a very pronounced increase in the demand for and supply of Class I, which type of engine is fitted into a lightweight machine averaging 190 lb., ready for the road. The two-cycle engine has crankcase compression and an average piston displacement of 14 cu. in. But

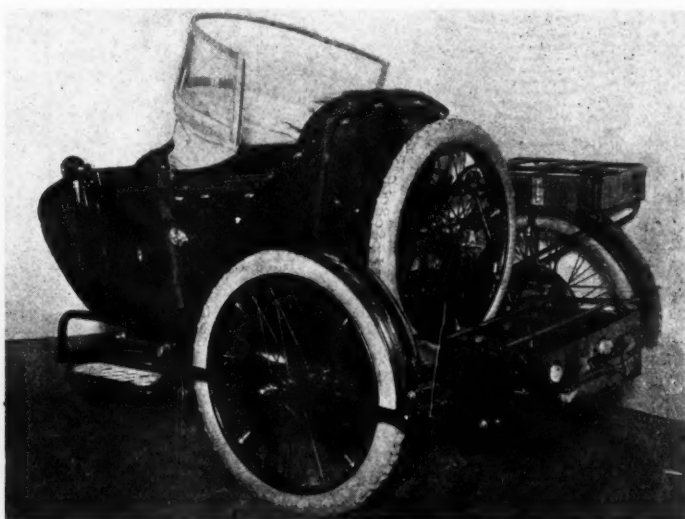
an equally strong tendency is observable at the other end of the scale, for the number of makers now standardizing a heavy sidecar machine with an 8 to 10 h.p. twin Vee engine is large, though there is a falling off in the Vee type of motor for engines of $3\frac{1}{2}$ to 5 h.p.. The place of the latter is rapidly being taken by the two-cylinder four-cycle with horizontal opposed cylinders. The original machine of this type, the Douglas, has been extremely successful, and the plant at Bristol, where these machines are made, has now one of the largest outputs in the United Kingdom, just over 300 per week. For solo work the single cylinder four-cycle engine is most widely used, and while it was primarily designed for this class of use it is very popular for light sidecar attachments.

This class of machine probably has no counterpart in the U. S. A. Its originators on any scale of production were Triumph and Levis, but at the present show this type is exhibited by 40 per cent of British makers, either as their sole model or as one of two or three. From the average weight and piston displacement already given, it will be seen that the weight per cubic inch displacement works out at 13.7 lb.

In these two cycle engines, the stroke is very rarely much greater than the bore. The latter averages 2 7-16 in., while



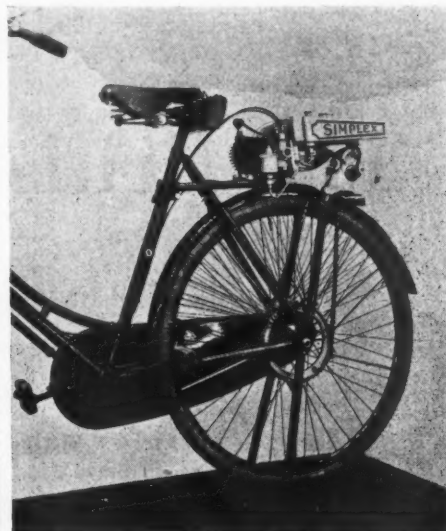
Spare wheel, platform and tool box behind A. J. S. de luxe sidecar



Spare wheel and luggage rack on Ruby sidecar; under luggage two spare two-gallon tins of gasoline are carried



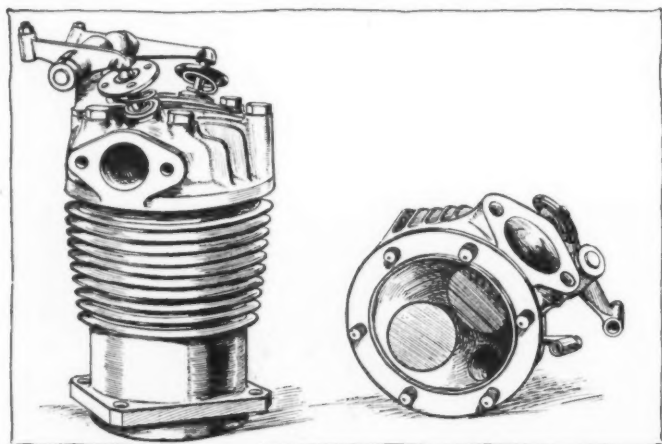
Typical scooter with seat. Has $1\frac{1}{2}$ h. p. horizontal single cylinder engine with chain drive to rear wheel. Wheels are 17 in. in diameter with $2\frac{1}{2}$ in. tires



Motor unit on pedal cycle. Engine is $1\frac{1}{4}$ h.p. with magneto ignition

the stroke is usually around $2\frac{3}{4}$ in. The machine usually has two speeds, though some makers offer a single speed model at a lower price. A V section belt invariably serves for the drive, though when two speeds are provided, the drive from the crankshaft to the separate unit gearset is conveyed by a roller chain. From the box a belt passes to a V section rim on the rear wheel.

These little machines have now become quite practical mounts for use on main and secondary roads in Great Britain, and even the single speed model will climb gradients steeper than 10 per cent and from $\frac{3}{4}$ to a mile in length. But they have to be in good trim and driven by expert riders to make this showing regularly. Hence the two-speed gearset, which is found on the majority. The wheels are usually of 24 in. diameter, with 2 in. or $2\frac{1}{4}$ in. beaded edge tires, and the average weight of the complete machine is, as mentioned, about 190 lb. They will attain 35 m.h.p. with ease.



The A. B. C. detachable head cylinder with overhead valves. Very short valve springs are used on this used cylinder horizontally opposed engine

As regards prices, there is only one maker at the show out of over 30 asking less than \$170 (current exchange rate). The average is \$250, while some of these machines cost nearly \$300.

There is, however, considerable scope for both weight and price reduction in this class of machine, and when they can

be sold weighing not more than 120 lb. and costing, with a two-speed gear, about \$130, they will meet with an immense demand which is not yet being catered for.

The only present attempts to cope with this demand lie in the direction of motor scooters, which are now developing into lightweight motor cycles. Some have two-speed gears, large, comfortable seats, bicycle steering, and, in fact, the principal differences between them and the lightweight two-cycle machine are the position of the motor, the drop frame and the small diameter wheels. The latter are usually $14 \times 2\frac{1}{4}$ in., the motor being arranged in three examples as follows:

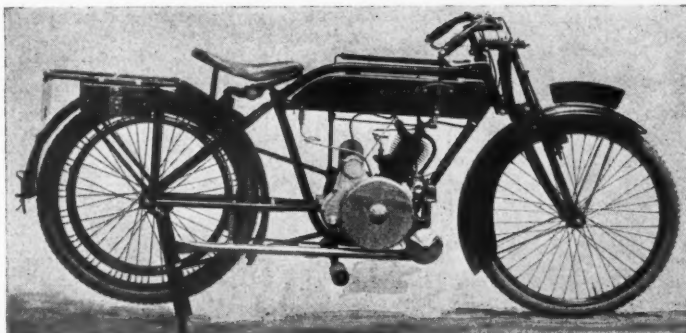
- (1) Alongside the front wheel.
- (2) Over the rear wheel.
- (3) In front of the rear wheel.

The best examples of these scooters will run up to 25 m. p. h. and climb 10 per cent gradients on low gear. Both two and four cycle motors are used, of about $1\frac{1}{2}$ h.p., with a bore and stroke both of $2\frac{1}{4}$ in. or thereabouts. Prices vary from \$140 to \$250, the lower figure being for machines which have no seat, the rider standing on a roomy platform secured to the base of the loop frame.

This class is not an extensive one, only two representatives being at Olympia; but one of these is being put down for production on a fairly large scale, approximately 100 per

Sedan sidecar on twin cylinder Bat. Feature of the machine is the separately sprung wheel of the sidecar chassis





2½ h. p. Clyno single two cycle machine; one of the very few with engine and gearset as unit. Enclosed outside flywheel and belt final drive



One of the most "advanced" designs—the Beardmore Precision, a single cylinder lightweight. Tank forms part of frame. Note laminated springs for fore and aft suspension

week. The unit is mounted over the rear wheel, and consists of a two-cycle engine driving through spur gears to a countershaft which carries a hand-operated clutch and a sprocket for the final chain drive. The driven sprocket is supported by four arms which attach directly to the tire rim. A high-tension magneto is used for ignition, while the fuel tank is mounted overall. This outfit, without the bicycle itself, sells at approximately \$100. It will climb short 10 per cent gradients unassisted by the pedals, and run at 20 m.p.h. on the level.

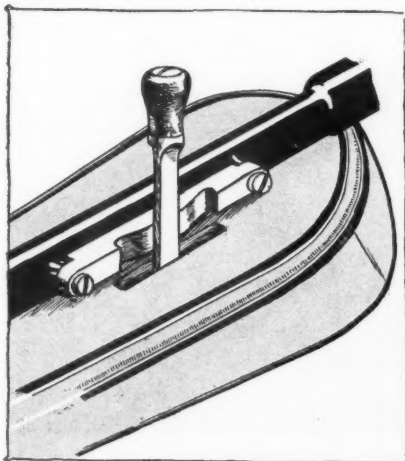
The so-called lightweight machine, as already inferred, is becoming one of the most popular types of motor cycles in Great Britain. The two-cycle engine is worthily represented in the Scott motor bicycle, which has two water-cooled cylinders arranged side by side, low down in front of the driver in a loop frame, a honeycomb radiator, and a two-speed gear consisting of dog clutches bringing into use one or two roller chains forming the final drives. The rated power of this machine is 3¾ h.p., with a bore and stroke of 2¼x2 9-16 in. In the recent Auto-Cycle Union trial in Wales, it put up a remarkable performance, especially on hills, and although there are other two-cylinder two-cycle machines in the show, the Scott is generally recognized as standing in a class of its own. It weighs, complete with fuel, approximately 300 lb.

This type has more representatives than any other except the two-cycle lightweights, being represented on the stands of 37 per cent of the motor cycle manufacturers. It has an approximately square engine with an average piston displacement of 28 cu. in.; its average weight, 270 lb., gives it a ratio of 9.6 lb. per cu. in. In price it varies from \$320 to \$450, and, like the lightweight, more usually has a short

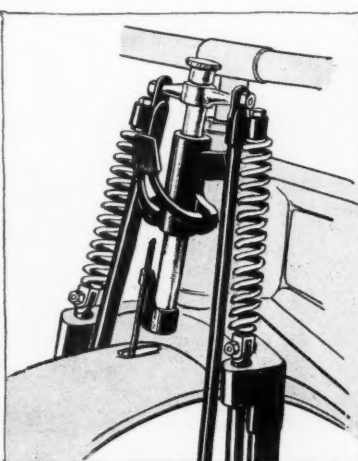
chain drive to a two or three speed gearset, with a belt drive thence to the rear wheel; but the all-chain drive is frequently seen, and in a few cases an all-belt drive. To obviate the need for a shock absorber in the transmission line when an all-chain drive is used, a type of chain is coming into use with these machines which embodies a series of springs that normally tend to prevent the chain links from being straightened out. In use, the driving length, i. e., the top of the chain, is pulled taut against the resistance of these springs, which thus constitute a buffer or shock absorber in the drive.

As already mentioned, this pattern is gaining ground in popular favor and threatens eventually to displace the Vee-twin from the medium-weight class (average 280 lb.). It provides an exceptionally good balance for a two-cylinder engine and enables a low overall height of machine to be provided. The latter feature will remain even if manufacturers decide to provide longer strokes, which does not apply in the case of vertical and Vee-twin engines, especially those with overhead valves; other things being equal, lengthening the stroke increases the height of the machine with other than horizontal engines.

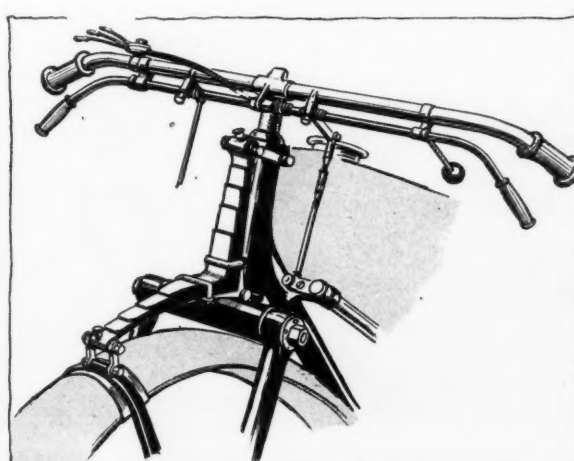
Although both the vertical single cylinder and the twin horizontal machines are used for sidecar work, they need a certain amount of "nursing" in exceptionally hilly districts, especially in summer and with a contrary wind. As a result, a big demand has developed for more powerful machines, and the 6-8 h.p. Vee twin is the outcome. This type is shown by 30 per cent of the exhibitors at Olympia and has an average weight of 460 lb., and an average piston displacement of 50.4 cu. in., the ratio between the two being therefore approximately 9.2 lb. per cu. in. Prices vary from



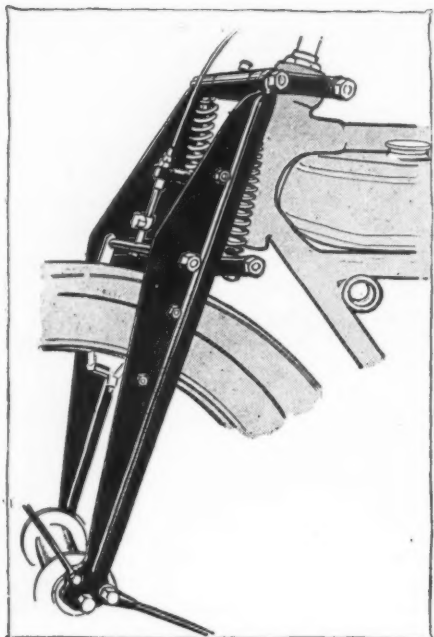
Gear control levers are sometimes brought up through the tank, as shown in this sketch of the 2½ h. p. James two-cycle model



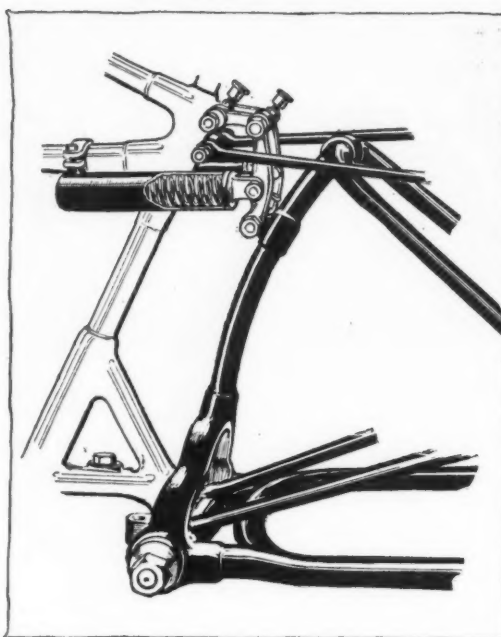
Plunger type front springing. Bottom ends of front tubes are mounted on axle; main fork members are shackled to it



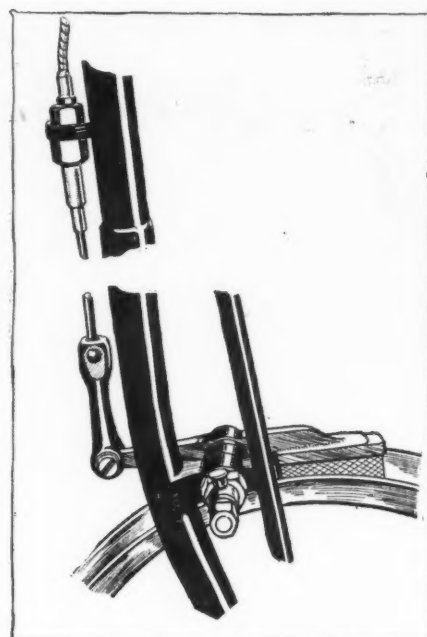
Laminated spring of front forks on Beardmore Precision. Sketch also shows rolling type brake levers and gear control (knobbed handle). Three small levers are: Air, throttle and ignition



Ariel girder front forks



An example of rear springing: The Douglas arrangement



Many front brakes consist of pad operating in grooved rim on front wheel. Sketch shows B. S. A. arrangement

Some of the British Refinements

\$420 to \$550 for the motor cycle itself, and from \$600 to \$750 with the sidecar, normally equipped. With an elaborate passenger attachment, electric lighting and generator, folding top and screen, the price frequently reaches \$850, and with a spare wheel, attachment and luggage carrier may closely approximate \$1,000.

Cylinders are, when air-cooled, nearly always of cast iron with integral fins and heads. The fins are discontinued just below the bottom limit of piston movement, with plain barrels thence to the flanged foot. The casting is bolted to the two-piece crank case, which has its joint vertical and at right angles to the crankshaft axis. Detachable heads are used by some, but for side valves they will soon be entirely discarded, owing to the inability of users to maintain compression-tight joints—or so say the makers; users complain that the leakage is often due to distortion arising from the unequally cooled mass of metal forming valve pockets at one side only.

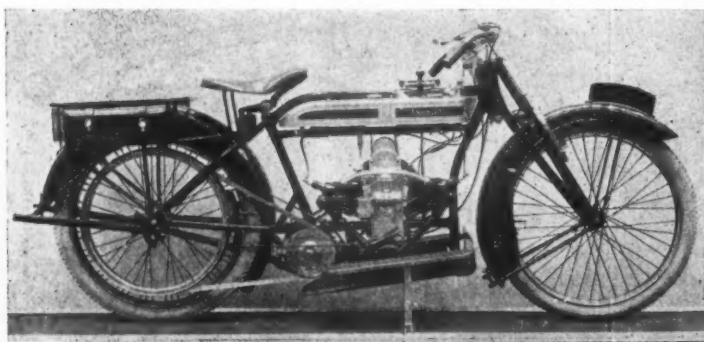
Ninety-five per cent of motor cycle engines have side valves, partly for the same reason that short strokes are used, namely to keep down the overall height of the machine. When there is one overhead valve it is always the inlet, but there are two machines in which the exhaust also is in the head, operated by push rods and rockers. One of these overhead valve (detachable head) engines is the A. B.

C., made by the manufacturers of the A. B. C. Dragonfly aero engine. It will run up to 4,000 r. p. m. and is unique in that its horizontally opposed cylinders are arranged transversely in the frame, with a bevel gear drive to the unit three-speed gearset, and thence by chain to the back wheel.

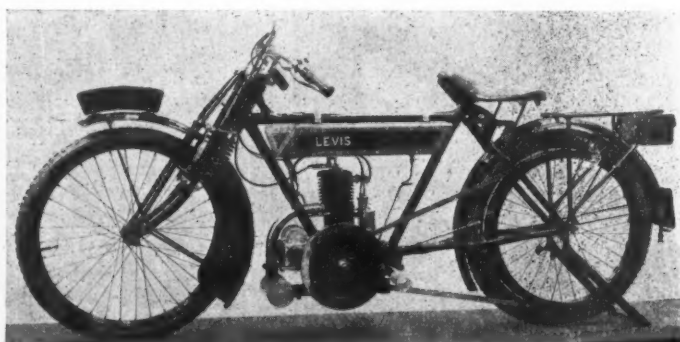
Without exception all motor cycles have high-tension magneto ignition, with an enclosed chain drive in the vast majority of cases. Carbureters are all of the float feed type, the majority having a two-lever control, whereby both throttle and air supply are regulated. The air regulation usually applies to a single jet and may take the form of a variable choke tube or merely a sleeve uncovering or closing variously shaped air inlet ports. The butterfly type of throttle is exceptional, the majority being of the piston pattern and generally operating within the air sleeve, in two-lever carbureters.

The automatic or single control carbureter is, however, gaining ground; but British motor cyclists are so keen on getting the best out of their machines in the way of speed and fuel consumption, that it will be some while yet before the skilled among riders will discard the two-lever control.

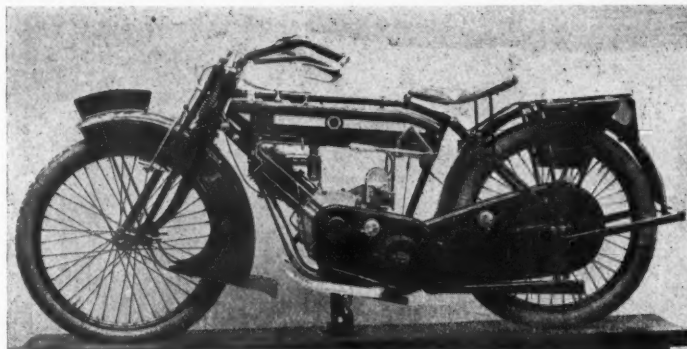
The cast iron straight-sided type piston occurs in considerably over 90 per cent of engines; a scraper ring is rarely provided, but drilled skirts are not infrequent. A few of the latest designs have aluminum slipper type pistons, but other-



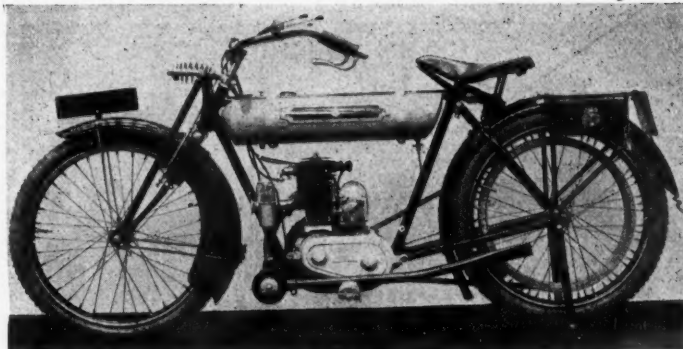
Horizontal twin cylinder Douglas, the original of its type. Has three speeds with chain and belt drive. Makers have second largest output of British motorcycles



The all-belt driven Levis, one of the originators of the single cylinder two-cycle lightweight type. Two-speed model also made. Weight, 160 lbs. without fuel and oil; piston displacement, 13 cu. in. Wheels are 24 in. in diameter



A popular single cylinder machine; the P & M with inclined engine (30.5 cu. in.) and all-enclosed chain drive



Made by the British firm with the largest output of all types; the two-cycle Triumph, which has two speeds and chain and belt drive

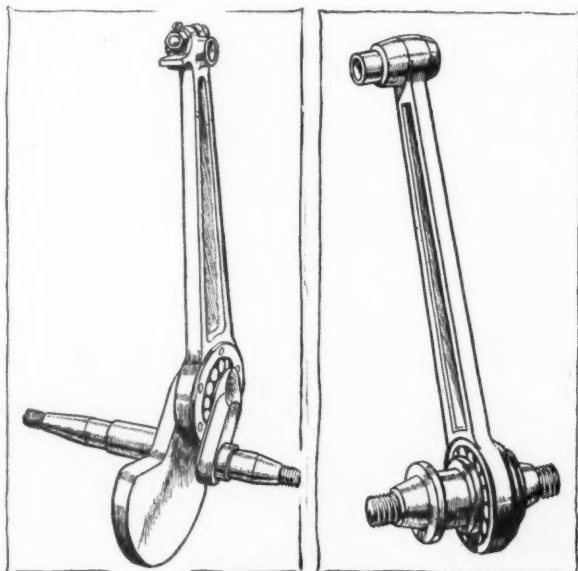
wise the aluminum piston does not appear to find itself in great favor.

There is a pronounced tendency to discard plain bushes for main and big-end bearing, their places being taken by parallel-sided roller bearings assembled without cages. In some cases the crankshaft is built up to enable the races to be fitted; in others an inner split sleeve is used for the connecting rod big-ends.

The majority of engines have simple splash lubrication, the oil being fed to the crankcase either directly by a hand-operated pump with which a charge of oil is provided at regular intervals, or by a pump and sight-feed drip which should (but rarely does) provide a regular supply of lubricant, as the drip feed adjustment requires frequent attention in most cases. Forced lubrication by means of a plunger or other type of mechanically operated pump is gradually increasing, however, the oil being led to the crankshaft bearings through the drilled shaft; but this type only appears where plain journals are used and a lead to the wristpin bearing is practically never adopted.

CLUTCHES

In the lightweight two-cycle engines the flywheel is invariably arranged outside the crankcase, but the single cylinder four-cycle motors, and the Vee twins have two internal flywheels occur with the crank pin uniting them. These three units with the shaft extensions serve to form the crankshaft.



B. S. A. crank pin and one of the two roller bearing connecting rods. Crank pin unites two internal flywheels

Beardmore Precision roller bearing connecting rod and crankshaft assembly. Single cylinder two-cycle engine

Three types of clutches are in evidence, the multiplate, cone and single disc. Both hand and foot control are used, the last-named the most extensively.

There are no transmission sets with more than three speeds, and more than two are rarely used on engines of less than $3\frac{1}{2}$ h.p. They are nearly always separate units bolted to the frame behind the engine crankcase. Before the war a large number of hub gearsets were in evidence, both with two and three speeds and with integral clutches; but these have practically disappeared before the separate unit, which is of either the sliding gear or constant mesh and dog clutch type. Where the all-belt drive is used, an expanding pulley on the engine shaft is provided, except on the single gear machines. Provision is generally made, with the expanding pulleys, for the rear wheel axis to be brought nearer to or farther away from the crankcase when the pulley diameter is increased, or reduced, as the case may be.

Almost every imaginable type of drive from engine to road wheel is represented at Olympia. The three most usual are:

- (1) Chain to gearset, belt to rear wheel. (51%.)
- (2) Chain to gearset, chain to gear wheel. (29%.)
- (3) Belt only. (12%.)

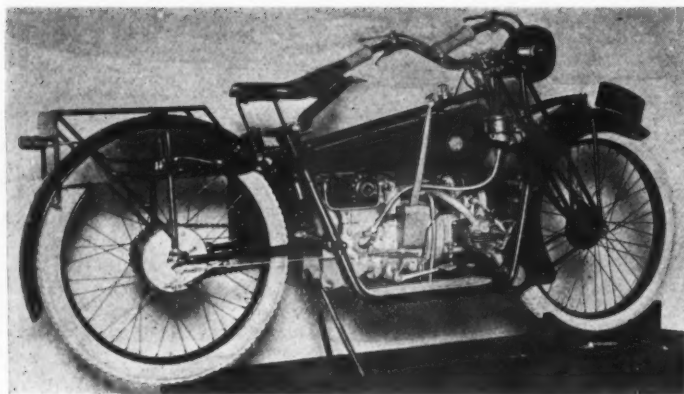
There are, however, one or two examples of the shaft drive, the notable instance being the Belgian F. N., which has a universally jointed shaft from the gearset with straight toothed bevels on the rear wheel. Both the single and the four cylinder F. N. have this form of drive, which, together with a few variations of the above, make up the remaining 8 per cent.

FRAMES AND SUSPENSION

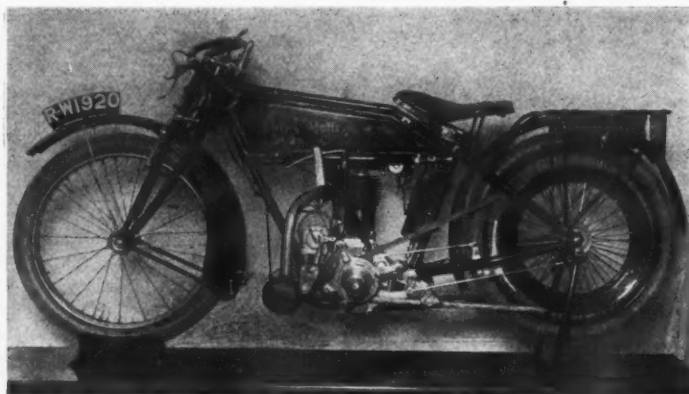
There is a decided tendency to improve both front and rear wheel braking systems, and without question it was badly needed in regard to the front braking. The judges, in their report concerning the recent A. C. U. trials, expressed the opinion that even then there were many competing machines which had front brakes that were neither safe nor effective in operation, becoming, in fact, in very many cases, inoperative by the end of the five days' test.

The criticisms in question referred to the stirrup type of rim brake with small fibre pads making contact with the inner periphery of the rim. At Olympia there are many improvements on this system. A few machines have bands applying to flat drums, but most of those on which the stirrup brake has been discarded have a Vee-sectioned brake rim, some 16 in. in diameter, to which is applied a large single pad operating in the groove. The advantage of this type over the stirrup brake is that mud and grit do not so easily render it inoperative by causing the actuating mechanism to seize. Rear brakes are mostly on the same system, and this type has been used in this position for many years. It is almost invariably pedal-operated, while the front brake is applied by hand. There are a few rear band brakes and one or two of the internal expanding type.

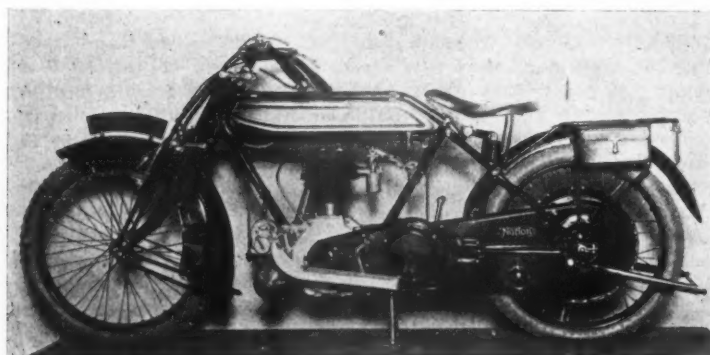
In the framework there is very little that is new in design. Tubular construction is universal, for although there was



The 4 h. p., single cylinder, four cycle Norton. Good example of its type, with all-chain drive completely enclosed. Bore and stroke $3\frac{1}{4} \times 3\frac{3}{4}$ in.; speed up to 65 m. p. h.



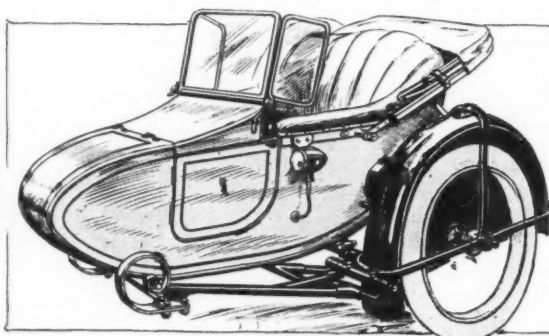
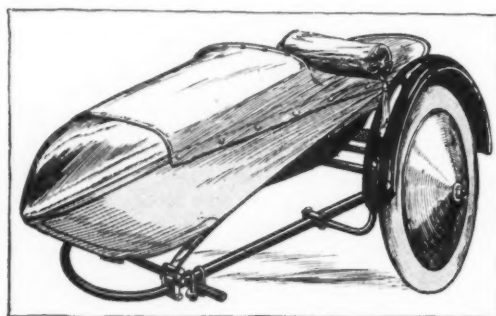
The $3\frac{3}{4}$ h. p. (30 cu. in.) Scott. Stands in a class by itself with its water-cooled two cycle, twin cylinder engine



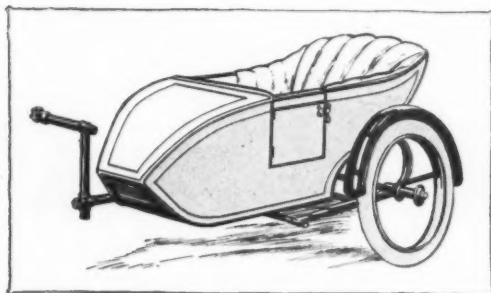
The 3 h. p. (24 cu. in.) A. B. C.; only machine with horizontally opposed twin engine, set with the cylinders across the frame. Has unit engine and gearset, laminated spring suspension fore and aft, and only machine with speedometer drove from gearset. Engine runs up to 4,000 r. p. m.



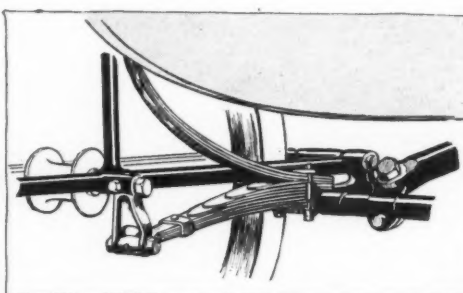
The Rudge Whitworth $3\frac{1}{2}$ h. p. Z 30.5 cu. in. single cylinder four cycle, with all-belt drive through an expanding pulley on the crankshaft. Popular machine known as the "Rudge Multi". Note dropped handle bars to suit "speed merchant." The word "Multi" refers to the number of gear ratios provided by the expanding pulley



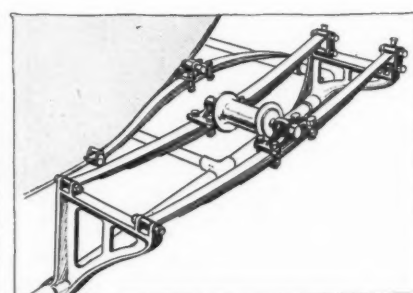
Typical "sporting" type sidecar



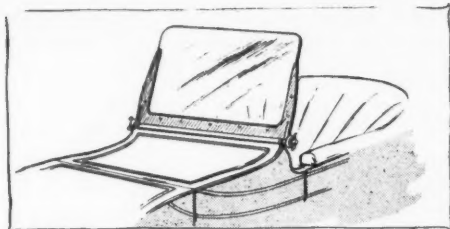
Normal type of sidecar



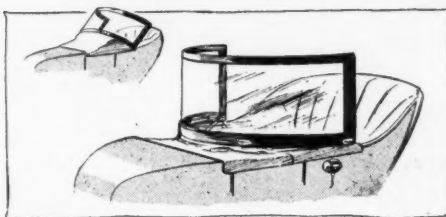
The Clyno sprung sidecar wheel, viewed from inside



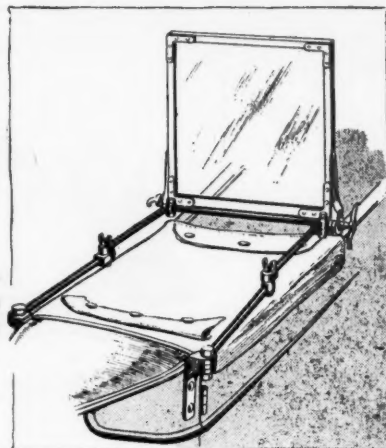
Another type of sprung sidecar wheel (hub only shown) the dual semi-elliptics on the Grindley outfit



Adjustable single panel
screen on hinged cowl



Above—The most
popular type of
sidecar wind-
shield. Celluloid
panel in frame of
leather covered
spring steel



On right—Adjust-
able screen on
double extension
arms

British Windshields

one exhibitor catalogued to show a stamped steel construction, his exhibit consisted merely of a pair of steel plates united by flat iron stays. Despite this fluke, it may be said with assurance that several well-known motor cycle manufacturers have experimental models of this type almost tested out; but they are kept under lock and key, and will not be seen by the public until purchasers refuse to be satisfied with the tubular construction. As it is, the exhibition shows a hundred ways of arriving at the same unsatisfactory end by the same basis method. Without exception the machines have a "ragged" and unworkmanlike appearance, with engine, tank, gearset, controls, etc., festooned around the tubular frame and unprotected from rain, mud and dust.

Frames and suspension are closely linked in motor cycle design, and the tendency in suspension is to build the rear wheel forks and stays as a separate unit, so as to provide a sprung suspension at the back. Spring front forks have been normal for ten or twelve years, but the tendency to provide a flexible suspension to the rear of the frame is new. It only occurs, however, in a minority of cases. Laminated springs in place of coil springs are also in evidence in half a dozen instances, and the Beardmore-Precision machine is a notable instance among British designs, as is the Indian among those emanating from the U. S. A.

In front fork designs the majority have parallel links which connect the fork to the frame, with coil springs forming the flexible member. But a few and the biggest British maker (Triumph) is among them—have the fork unit pivoted to the bottom of the steering head at a point which coincides with the fork crown; a buffer spring, which is occasionally in duplicate concentrically, being arranged at the top end of the fork extensions. An objection raised to this type is that the steering angle varies with every movement of the suspension system; for this reason, which implies constant variation of the wheel base, steering control may be adversely affected under certain conditions of use. However, riders who complain of faulty steering for this reason are so few and difficult to locate. The popularity of the Triumph machine should of itself go a long way towards justifying this system of front suspension.

Wire spoked wheels are universal, and although there are perhaps 50 machines at Olympia fitted apparently with disk

wheels, these are really of the wire spoked variety with detachable disks. The latter are supplied as an "extra" by the motor cycle makers and are sold as accessories by several dealers.

It is doubtful whether disk wheels will attain any pronounced popularity among motor cycle users, although the advantage of the type when cleaning operations are in progress is generally recognized. The principal objection is that when high winds are blowing, there is a risk, when the machine is passing side streets, of gusts of wind affecting the steering. Some riders maintain that this represents a positive danger, although others refute this view, and say that the effect of side gusts is practically negligible. It seems feasible, in view of this divergence of opinion, to assume that the balance of the steering wheel and of the machine as a whole may be such as to render side winds dangerous, while in other designs they may be practically without effect.

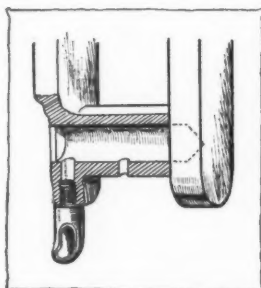
A pronounced tendency in sidecar models in particular, is to make the front and back wheels interchangeable, and both of them readily detachable without disturbing either the brake or the drive. Quite a number of sidecar outfits are now being fitted with spare wheels which are also interchangeable with the sidecar wheel. Sunbeam, Lee-Francis and A. J. S. are among the firms who are standardizing interchangeable wheels. The latter usually have journal ball-bearings, the outer race mounted in the hub shell and the inner on a connecting sleeve. The wheel is located by a spindle which passes through the sleeve and can be drawn out from one side when the nut on the other side is removed. The generic term for this arrangement is, "knock-out spindle system." The time occupied in removing the rear wheel, for example, is from one to two minutes. The drive from the chain sprocket is taken by a dog clutch, the two members of which can be separated to draw the wheel away by removing a spacer on the opposite side of the wheel, which can be taken away instantly the spindle is withdrawn. The usual wheel size for all machines larger than the two-cycle lightweight is 26 in. with tires of cross sectional diameters from 2 1/4 to 3 in.

Speaking generally, the prices of British motor cycles are not yet at double the pre-war figures, and there is every likelihood of their continuing to increase until that standard is reached, this on account of over 100% rise in cost of labor and materials.

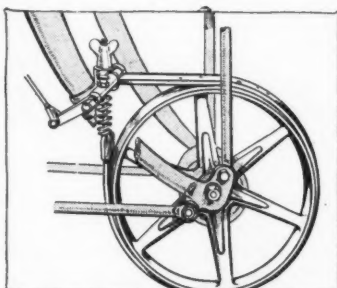
Summarizing the prices that have been named in the foregoing, the following may be taken to apply:

One cylinder, two-cycle solo machines	\$170 to \$300
One cylinder, four-cycle solo machines	320 to 450
Two-cylinder horizontally opposed solo machines.....	340 to 450
Two-cylinder Vee 3 1/2 to 5 h. p. solo machines.....	350 to 450
Two-cylinder Vee 6 to 8 h. p. solo machines.....	420 to 550
Two-cylinder Vee 6 to 8 h. p. with sidecar and acetylene lighting outfit	600 to 750
Two-cylinder Vee with sidecar, electric lighting, hood and screen	700 to 850

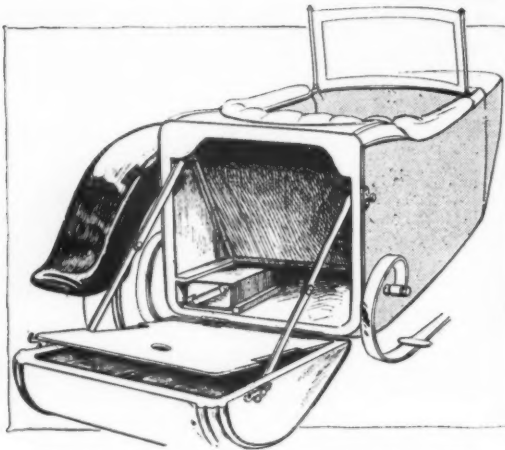
No well-known firm has any project announced for mass production. One or two new-comers talk of an output of 1,000 per week, but at present the two largest outputs are those of Triumph and Douglas, which are in the neighbor-



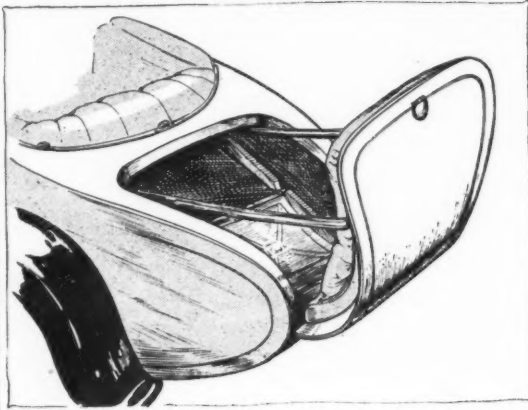
Oil Scoop on hollow
crank pin of Hum-
ber horizontal twin
cylinder. Pump de-
livers oil to troughs
as in car practice



Beardmore Precision
front wheel band
brake; typical of
tendency towards im-
proved front braking



Rear locker and luggage compartment on Norton sidecar. Space under floor for gun-case, fishing rod, etc.



Norton sidecar in one form has dickey seat for child; or space can be used for luggage

hood of 400 and 300 per week respectively. Between these two and the next biggest output is a big gap. The Rover Co. were turning out 50 machines a week before the iron-founders' strike, and hope to work up to 100 per week in 1920. The scale descends to quite a number of very small concerns, mostly private individuals, assembling as few as two or three machines per week.

A large proportion of the manufacturers purchase from component makers the engine, gearset and front forks, in addition to smaller items. A still larger number buy either engines or gearsets. The most popular engine is that made by J. A. Prestwich, London, known as the J. A. P., which is made in sizes from 2½ h. p. single cylinder to the 8 h. p. Vee twin which appears on the great majority of sidecar models having an engine of this type. The output of this firm at present is probably 800 per week, with between 30 and 40 firms using its productions.

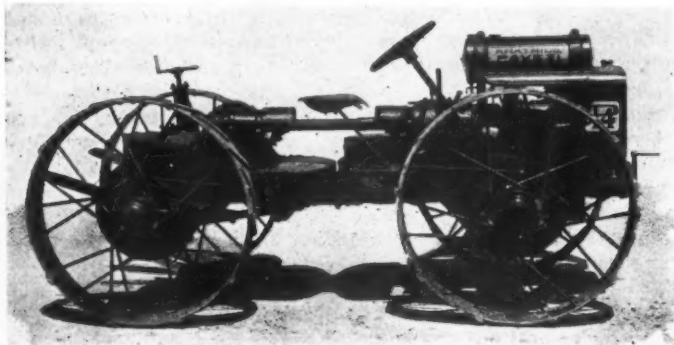
The most popular gearset is the Sturmey-Archer three-speed unit, which about 50 firms are using. The same num-

ber applies to Druid front forks, a spring system made with certain variations, but embodying the parallel link system, generally with a coil spring under tension. Magneto, carbureter, rims, for both tires and belts, and speedometer, are all bought from specialists, while the controls for carbureter and magneto are, with few exceptions, of the Bowden cable type in which the operating cable moves within a coiled steel wire casing. No British firm is using the twist handle control, exterior clipped-on levers being general. Some machines bear as many as five exterior levers on the handlebars, two for the carbureter and one each for the magneto, front brake and exhaust valve lifter.

Approximately 50 per cent of the British output of motor cycles is produced by firms who manufacture themselves the main units of the machine, though one or two of these even buy either a J. A. P. engine or a Sturmey-Archer gearset. The following are included in this category: Triumph, Douglas, Sunbeam, Humber, Clyno, Rudge-Whitworth, Enfield, Excelsior, Raleigh and B. S. A.

Italian Road Tractor for Colonial Work

THE Societa Anonima La Moto-Aratrice, of Milan, Italy, has recently issued photographs and descriptive details of a 4-wheel driven road tractor which it is building specially for colonial use; such road tractors were of great use in carrying heavy loads during the war. The Pavesi tractor, which is the



Pavesi P-4 four-wheel drive agricultural tractor

chief element of these road trains, has the power transmitted to all of its four wheels through roller chains. The frame is of very flexible construction, and therefore the tractor can negotiate the roughest roads. No steering knuckles are used, and the front axle being a single piece, is of great strength.

All four wheels are used for steering purposes, and the tractor, therefore, can be turned around in a small radius.

The general construction of this road tractor appears to be similar to that of the Pavesi farm tractor already described in AUTOMOTIVE INDUSTRIES. The wheels are fitted with solid rubber tires of about 41 in. in diameter, the front tires being 5½ in. in width and the rear tires 6½ in. For colonial service, however, wheels of larger diameter (about 48 in.) are more suitable, and such wheels can be furnished, fitted either with lugs or with solid rubber tires. Four speeds are provided, ranging from 2 to 10 m. p. h., and in addition there is one reverse speed. A tractor has a tread of 64 in., and a wheelbase of 112 in. Its weight in running order is 6,200 lbs.; it is capable of carrying on its own platform a load of 5,500 lbs., and the total load which can be hauled on level roads is about 30 tons.

DURING the early part of April next there will be a sea-plane competition at Monaco to which prizes of 100,000, 30,000, 12,000 and 8,000 francs are attached. The contest is open to machines of all allied nationalities, but each machine must be wholly the product of one nation. The pilot must be a citizen of an allied nation, and must hold a pilot's certificate of a body affiliated to the Federation Aeronautique Internationale. The flight is to be made in three stages, the first being from Monaco to Corsica, the second around the Island of Corsica, and the third back to Monaco. The total distance is 2,000 kilometers (1,250 miles).

Accessory Exhibit at the Olympia Show

Crowds flocked to the galleries where the non-puncture tire was shown, as this had been made a popular mystery for a year. Disc wheels, worm gears, magneto equipment, spark plug tester and windshield are other novelties that are considered worthy of mention

FULLY as much interest was shown by the visitors to the Olympia automobile show in the accessories as in the complete cars. At times the crush in the gallery, where the accessories were exhibited, was such as to prevent movement one way or the other, and at certain centres of special interest—the stand where the Rapson “unpuncturable” tire was on view, for instance,—one might wait 10 or 15 minutes before getting a sight of the exhibit.

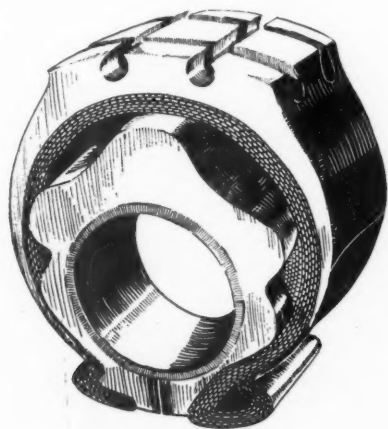
The advent of the tire referred to was boomed for nearly 12 months, and much mystery was made of its design and construction until recently. It is now being tested by the Royal Automobile Club over a distance of 10,000 miles and, despite objections that have been raised to the principle it embodies, it is likely to “catch on” with a large section of the British motoring public if it survives the trial by covering the distance without puncture. Punctures are one of the great bugbears of motoring in Great Britain, and it is no frequent experience to have two or three in the course of a day's run of 150-200 miles; thus motorists are prepared to sacrifice something to attain freedom from puncture.

The Rapson tire consists of a beaded edge cover of normal canvas construction except for a circumferential ridge projecting inwardly from each side of the car case. These ridges locate an endless and separate interior band, or “deflector” as it is termed, formed of rubber, with four circumferential

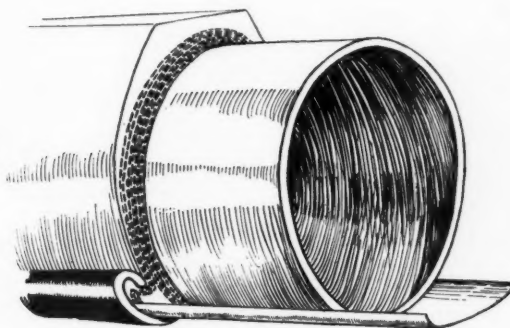
grooves on its outer surface, two of these grooves coinciding with the ridges within the cover. The ridge on the band, which is between the other two grooves, is immediately under (or over, as the case may be,) the tread of the tire. Within the “deflector” is an inflated air tube of conventional construction and shape but obviously smaller in cross sectional diameter and cubic capacity than the size of cover would normally contain.

It is claimed for this type that, when the imposed weight flattens out the tread, the central ridge of rubber on the deflector is displaced towards either side, and that, except in the case of an instrument of puncture which may enter exactly at the centre, this molecular movement deflects the nail or other substance laterally and prevents it reaching the air tube.

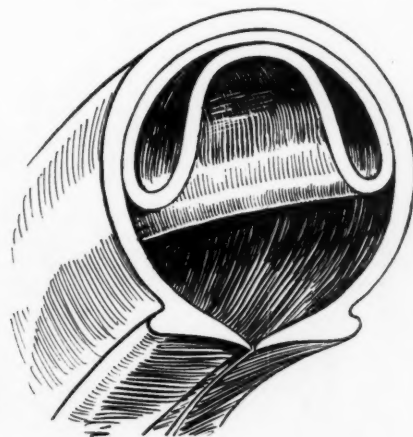
Whether this movement has the effect claimed or not, it is clear that the deflector must assist in preventing puncture by increasing the thickness of rubber between road and tube; but critics point out that this thickening of the tread—for that is what it amounts to, ignoring the special claim—must reduce resiliency, especially in tires of the smaller sizes. The set now under test is in use on a Rolls-Royce car and the covers are 5½ in. in section; a similar set has been tested privately—by the inventor and motor journalists—and is said to have run 10,000 miles without the treads being renewed and without puncture or burst.



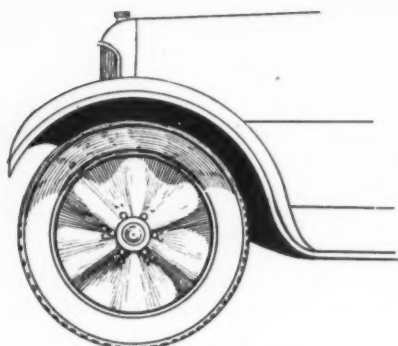
Section of the Rapson “unpuncturable” pneumatic type



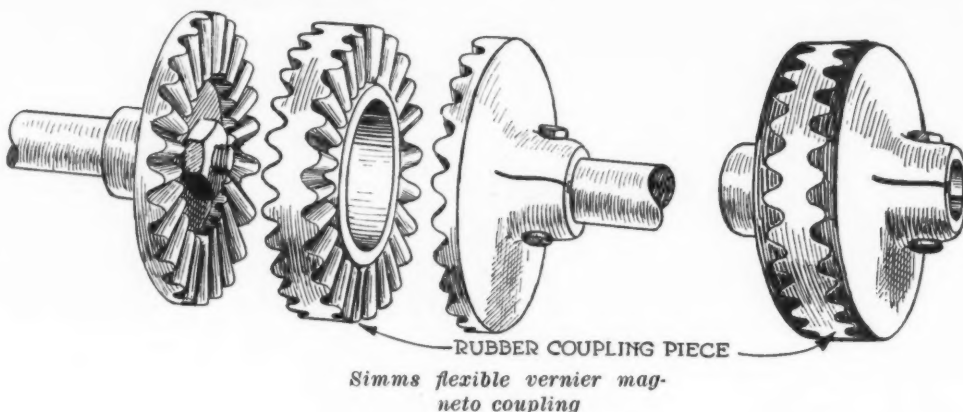
The Leosco Tube Saver



The Non-Nip air tube in the position it assumes when deflated



The Corrugated type of single disc wheel



Disc wheels, which are becoming very popular in England, were shown by Michelin, Goodyear (a British firm of Dudley, not the American Tire Co.), Lynton, Riley, Sankey and Steel Stampings, Ltd. Single and double discs were in evidence, but the usual pattern has a single disc, riveted or spot-welded to the clincher-edged tire rim, the outer circumference of the disc being pressed over at right angles to form a flat surface on to which the rim may bed. The wheel is held to the hub by a series of studs and nuts. The Goodyear wheel has a single corrugated disc with a view to obtaining greater lateral strength and is standard on the Angus Sanderson among other British cars.

The makers of single disc wheels in England have not followed the lead of Michelin, who makes the disc thicker at the centre than at the circumference, the steel in cross section tapering gradually from hub to rim.

The Sankey hollow steel wheel built up of two stamped sections, each forming half of hub, spokes, and rim, welded together at the centre line, is still widely used; the Goodyear Co. of Dudley has a new type on similar lines, but with a one-piece rim clinched by the inturned edges of the fellow part of the wheel halves. This pattern is claimed to have overcome the liability of the Sankey type to gape and split at high speeds in the weld at the base of the integral rim.

WORM GEARS

Among the components exhibits in the gallery David Brown & Sons of Huddersfield had a big display of their worm gears, with a new tooth formation which is said to have a 66 per cent rolling contact. Recent tests of this gear by the National Physical Laboratory (London) showed a minimum efficiency of 93.4 per cent (this was at 750 r. p. m. with a load of 31.3 h. p. being transmitted), while at 1,500 r. p. m. with a load of 18.9 h. p. the efficiency worked out at 97.3 per cent. The Daimler-Lanchester worm gear testing machine was used, for which is claimed an accuracy of ± 0.1 per cent. It was observed, however, that this firm, so well known as worm gear specialists, were exhibiting examples of their work in the form of spiral bevel

gearing, showing that they are alive to the increasing popularity of this form of drive and have made arrangements to meet the demand in this direction.

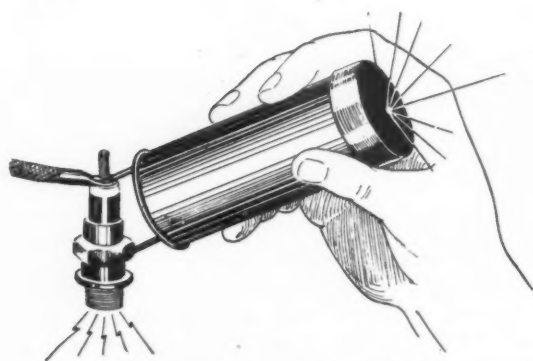
Apart from Wrigleys of Birmingham, no firm of note was showing complete axles and gear-sets, but several engine specialists exhibited their products.

MAGNETO EXHIBITS

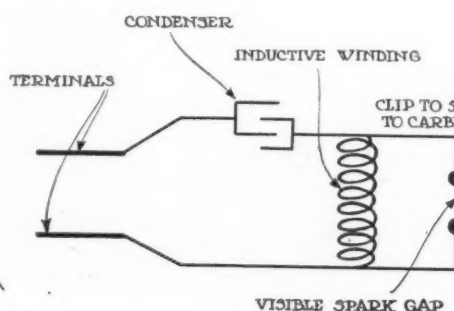
The Simms magneto coupling attracted attention on the standing of the magneto manufacturing concern bearing that name and was seen fitted to several cars on the floor of the main hall. It forms a flexible vernier joint and consists of two flanges with teeth on their faces, and similarly toothed coupling piece of rubber compound between them. On the standard size ($2\frac{1}{2}$ in. diameter) one flange has 19 teeth and the other 20, providing a minimum range of adjustment of less than 1 deg.

Another magneto firm's exhibit included a battery ignition set. This is the C. A. V., one of the first British equipments of this nature. It is peculiarly reminiscent of the Remy in the design of its components and in one form is made to interchange with the standard British magneto as to dimensions of plate and centre line of driving shaft. The contact breaker is of the closed circuit type, a thermostatic switch being provided to come into action if the engine comes to rest with the battery short circuited. In another form the set is mounted on the dynamo.

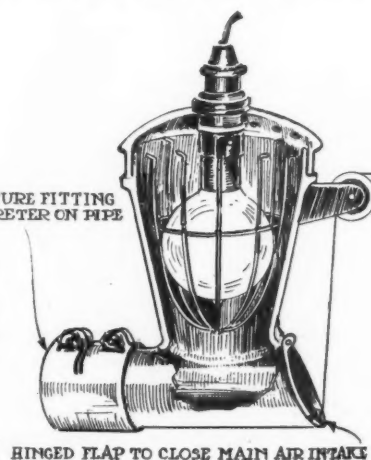
An interesting electrical accessory is the "Radamax" spark plug tester, shown by S. Smith & Sons (M. A.) Ltd. It is an instrument of precision in which use is made of the idea employed in a wireless telegraph transmitter, namely, the combination of the secondary discharge from a condenser with that of an inductive circuit. In the Radamax tester the insulated end of the spark plug is connected to one side of a condenser, the other side of this condenser being connected to "ground" through an inductive winding and a secondary spark gap in parallel. One terminal of the tester is placed on the plug terminal and the other on the



The Radamax spark plug tester in use



Windings of the Radamax plug tester



The Quick Start Vaporiser

body, and when a spark takes place at the plug points the rapid variations in the electric pressure have the effect of charging and discharging the condenser in unison with them, the tremendous speed at which this occurs causing the discharge to rush across the secondary gap provided in the tester in preference to the alternative path through the inductive circuit. The occurrence of this secondary spark therefore shows that a useful spark is actually taking place at the plug points. If the plug points were shorted by carbon or from any other cause the rapid variations in electric pressure would not take place, the current then passing in a comparatively steady stream and the secondary discharge from the condenser would have time to pass through the inductive circuit, no spark being produced at the visible gap. Any other fault at the plug will produce the same result, no secondary spark being shown in the instrument.

The Radamax tester is made up in the form of a tube some 4 in. long with two pins projecting from one end and forming the terminals which are held to the plug under test. At the opposite end the secondary gap is placed beneath a small window where it can be easily seen. In another form it is made up as a dashboard instrument with press buttons, one for each cylinder, so that the spark can be tested from the driver's seat.

An accessory designed to facilitate engine starting from cold was shown by Brown Bros. Ltd., the well known dealers. It is called the Quick Start vaporizer, and consists of an elbow piece to be clipped to the main air intake of the carbureter. A flap valve can be operated to close the direct inlet and cause the air to be drawn through the vertical branch, the latter contains an incandescent electric light bulb of such diameter that its sides only just clear the metal body of the fitting. It is claimed that the air passing around the bulb when the latter is aglow is sufficiently warmed to vaporize quite heavy gasoline in winter and thus ensure a ready start. The current used may be taken from the bat-

teries of the car's lighting and starting equipment or from the garage lighting circuit.

The Leosco tube saver, a thin endless band of rubber and interwoven fabric is intended to protect the air tube from the ill-effects of the rust that is so prevalent on the rim base. This device not only protects the tube but also removes the need for periodically scraping and repainting the rim interior.

Another specialty is an air-tube that normally—when deflated—assumes a shape resembling, in section, a double and inverted U, causing it to stand away from the rim, against the underside of the tread, when the cover edges are being removed or replaced.

Windshield makers occupied a number of stands, and without exception each exhibited one or more models with adjustable "wings." One of these is shown in an accompanying illustration, and has in addition to the wings an upper panel divided in the centre, with each half capable of being individually adjusted. A divided top panel is not frequently met with on flat-fronted shields, but V fronts with separately adjustable top panels are very popular on sedan bodies.

Windshields for the rear seats of four-passenger open bodies were largely in evidence, both among the accessory exhibits and on the complete cars on the ground floor. They are usually secured to the back of the front seat by two arms, each with three joints, allowing the screen and side wings to be drawn towards or pushed away from the passengers. When not in use they can be folded and hinged down against the back panel of the front seat. A waterproof apron is secured to the lower edge of the shield frame and is thus brought into use as the shield is drawn back. This type of shield is sold with fittings allowing it to be attached to existing bodies, but many back shields were to be seen, among the car exhibits, attached to the rear edge of a hinged central cowl.

The 1920 Rolls-Royce

EXTREME reticence regarding chassis design has for many years past been a policy of Rolls-Royce, Ltd.; although the same policy is being maintained, a few details of this concern's 1920 chassis are available. The engine remains a six-cylinder L-head type of the same bore and stroke as in 1914, viz.: $4\frac{1}{2} \times 3\frac{3}{4}$ in. The Rolls-Royce carbureter is still being used, with its governed and direct acting throttles. Force feed lubrication and pressure fuel feed are continued. Two separate ignition systems are in evidence, a plain magneto and a battery and coil. The cone type of clutch has a fabric facing and drives through flexible joints to the four-speed gear-set. The latter has side lever control and is mounted in the main frame separately from the engine.

The propeller shaft is enclosed in a torque tube and has a star type universal joint at the front end; there is no universal in the ordinary sense at the rear end but a spherical serrated joint gives slight flexibility in the propeller shaft coupling to the straight-toothed bevel pinion. The ratio of the final drive is 3.25 to 1: the wheel diameter being 895 mm. (approx. 40 in.), back and front; the rear tires are, however, larger in section than those at the front, the sizes being respectively 150 mm. (6 in.) and 135 mm. ($5\frac{1}{4}$ in.), both on wire spoked wheels.

A special feature of the chassis is the design and arrangement of the electrical engine starter which drives the engine through the gear-set and clutch; it is claimed that the gearing is silent in operation and that the starter transmission has a high efficiency.

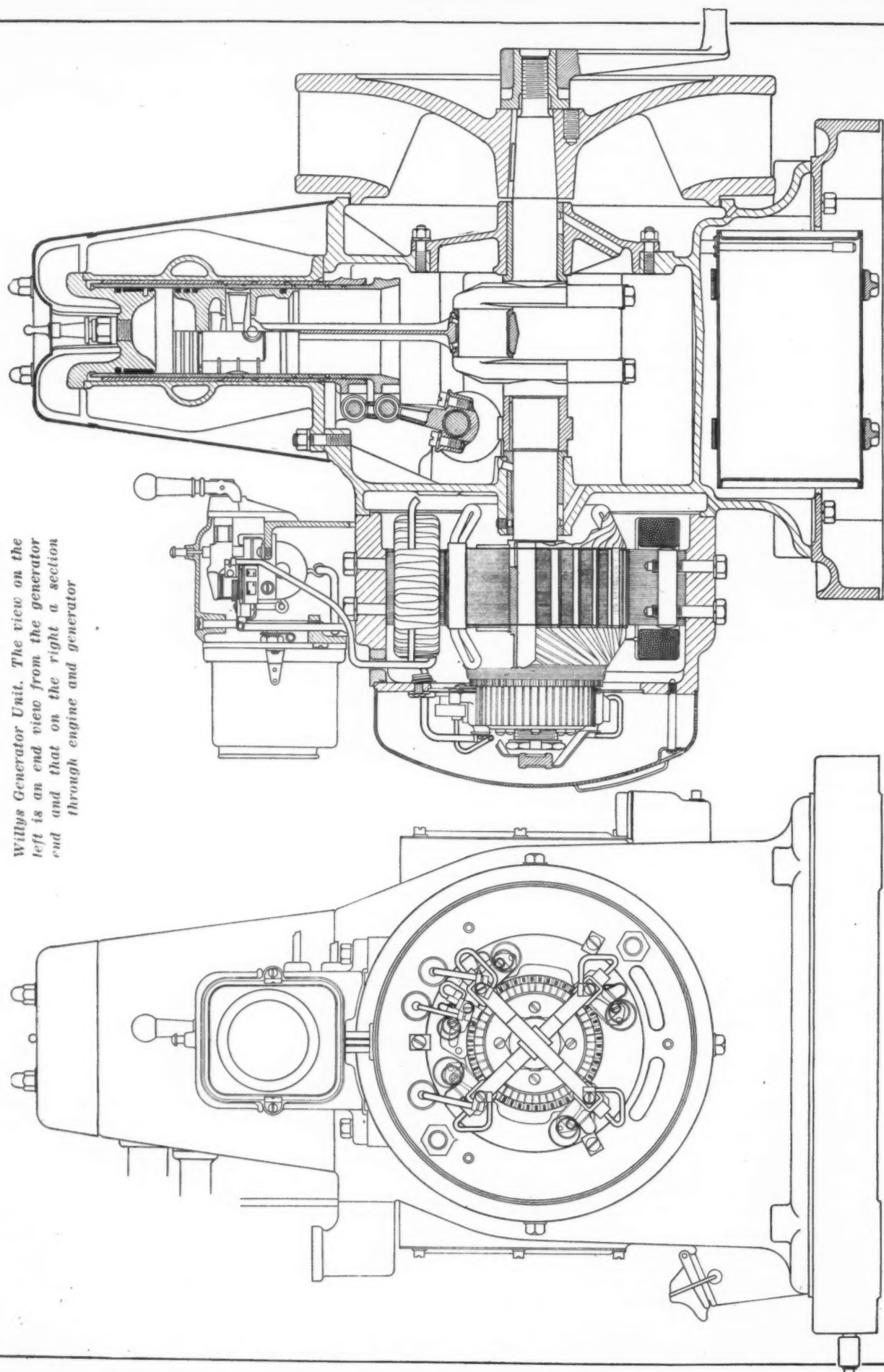
The chassis, which is priced at £1,575 (approximately 7,000 s.) is thus 750 s. less than the new Napier; it weighs 3,080 lb., and has a wheelbase of 144 in. and a track of 56 in. Each chassis is sold with a three-year guarantee and

the company undertakes not only to replace defective parts but also to fit them free of charge. They will also send an inspector to the user's garage once a year for the three years to examine and report upon the condition of the car.

The plant at Derby is still occupied on government work, turning out a new type of Rolls-Royce engine for airplanes of considerably higher power than the models already in use; the productive power of the plant in regard to car chassis is therefore still restricted and probably less than 350 cars will be made during 1920—at all events unofficial statements have it so.

IN manufacturing tires, every time a tire is cured in the mold, a thin skin of rubber is deposited on the inside of the mold, about the thickness of onion-skin paper. After a number of cures have been effected, the efficiency of the mold decreases, and the quantity of rubber on the tire is materially lessened. Sometimes the adherence of rubber to the mold even goes so far as to obliterate the numbering and lettering on the side of the tire, and also to disfigure the non-skid treads. It is then necessary to clean the mold, and the processes employed today consist either in cleaning it out with a scratch brush, which takes an hour or so, or in dipping the whole mold in molten lead, which burns off the skin of rubber. This latter process has the advantage of being liable to warp the mold.

George B. Malone, of the K. G. Welding & Cutting Co., has developed a torch fitted with a monel metal tip, with which it is possible to clean out the mold and blow the ash entirely away in from 6 to 12 min. Monel metal is used for the tip because it has a conductivity of only 1/15 that of copper. We understand that the Fisk Rubber Co., of Chicopee Falls, Mass., is now using this method and that a number of other tire companies are interesting themselves in it.



Willlys Generator Unit. The view on the left is an end view from the generator end and that on the right a section through engine and generator

Knight Engine Adapted to Two-Unit Farm Lighting System

Spherical combustion chamber is a feature of this motor, which is the first air-cooled single cylinder Knight engine ever produced. The construction and operation of this new engine are described in the following article

COMPACTNESS and simplicity in construction and operation are recognized by manufacturers of farm lighting plants and small isolated units for use in farm households, as a necessity. These are the distinguishing characteristics of the Willys light, which in addition makes use of the first air-cooled single cylinder Knight engine ever produced.

The entire mechanism compares two units, the first of which consists of the engine, generator and control mechanism, compactly combined and enclosed. The other unit includes the storage battery. The sleeve valve engine in connection with the generator is a self-cranking type, requiring no governor, and is designed to stop automatically when the batteries are fully charged. It is designed to run on kerosene, and one of the claims of the manufacturers is that its fuel cost is only 50 per cent as much as when gasoline, distillate, or gas is used.

The engine is a product of the Willys Corp., members of which have been building Knight engines for the Willys-Knight cars for several years past. The generator is a product of the Electric Auto-Lite Co., whose output of small generators is well known in the automotive field. The batteries are 32 volt, 16 cell, 9 plate per cell type enclosed in sealed glass jars. They have a capacity of 160 amp. hr. by the 8 hr. rating, and 225 amp. hr. by intermittent rating.

The layout of the system is extremely simple, the single cylinder, sleeve valve Knight engine being direct connected, so that the crankshaft is merely an extension of the armature shaft of the generator. The engine is $2\frac{7}{8}$ by $3\frac{1}{2}$ in., and develops 2 h. p. at 1,100 r. p. m. It is fitted with an aluminum cylinder head, particularly designed to dissipate heat. The cylinder is a gray iron casting with cooling fins cast integral. Except for the fact that radiation qualities have been gone into to a much larger extent than usual, the single cylinder engine does not depart from well-known Knight practice.

A feature in the design of the engine is the spherical combustion chamber gained by the shape of the aluminum head and the aluminum pistons. Explosion takes place within a hollow sphere of aluminum. This chamber is closed all around except for a distance of $\frac{3}{4}$ in. above the piston. The intake gases are taken in in an interesting manner, the intake manifold being bifurcated around the cylinder so that the gases receive a preliminary warming before entering the combustion chambers. The fuel control is by means of a needle valve located within a venturi passage, this acting as the carbureter.

The inner and outer sleeve valves are driven off an eccentric shaft, which takes its motion from the crankshaft by

helical gearing. The eccentric shaft is located at right angles to the crankshaft, and is a stub shaft long enough to take the inner and outer sleeve driving connecting rods and the timer at one end and the oil pump at the other. The connecting rods and crankshafts are drop forgings, and keyed to the crankshaft is an air suction type of flywheel designed to force air through the cooling jackets. Counterbalance weights are bolted to the ends of the crank throws to put the crankshaft in rotary balance. An interesting point in the way the cooling system is worked out is the venturi-shaped opening around the spark plugs so that the air is drawn past the plugs at maximum velocity to help cool the plugs. In addition to this, it will be noted that the plug is mounted in the aluminum casting to permit of rapid radiation of heat from the points.

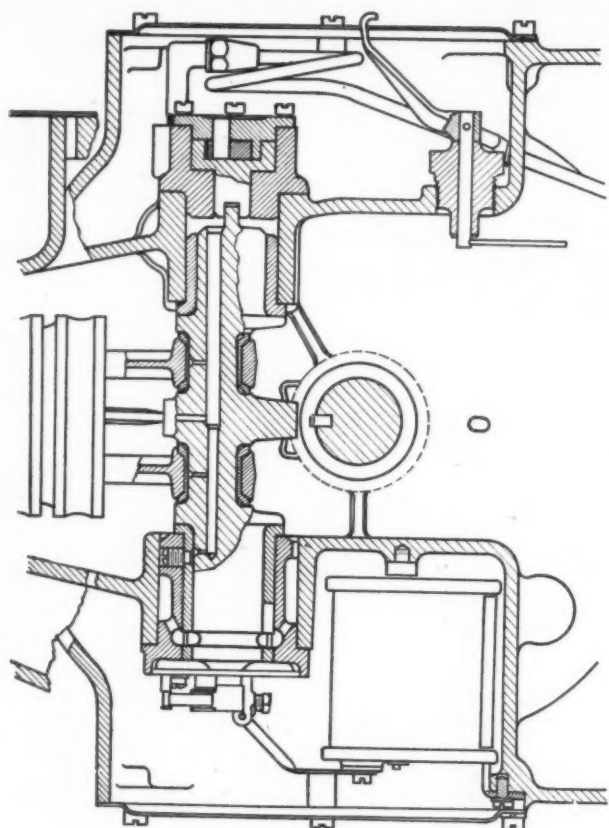
Lubrication is by combined pressure and splash, the oil being carried in a reservoir in the base of the engine below the crankcase. The oil is forced to all of the bearing points throughout the engine, and in addition the connecting rod dips to a sufficient extent to provide a spray or splash feed. The oil from the pressure pump oils the eccentric shaft, the main bearings and the sleeve connecting rod bearings, as well as the spiral gears for driving the eccentric shaft. The cylinders are oiled by oil vapor. There is no direct splash from the rods.

The method of governing the engine is by a fixed air passage which restricts the engine under load to 1,100 r. p. m. Running light, it would not run in excess of 1,600 r. p. m. The oil consumption is about $\frac{1}{4}$ pt. per gal. of fuel.

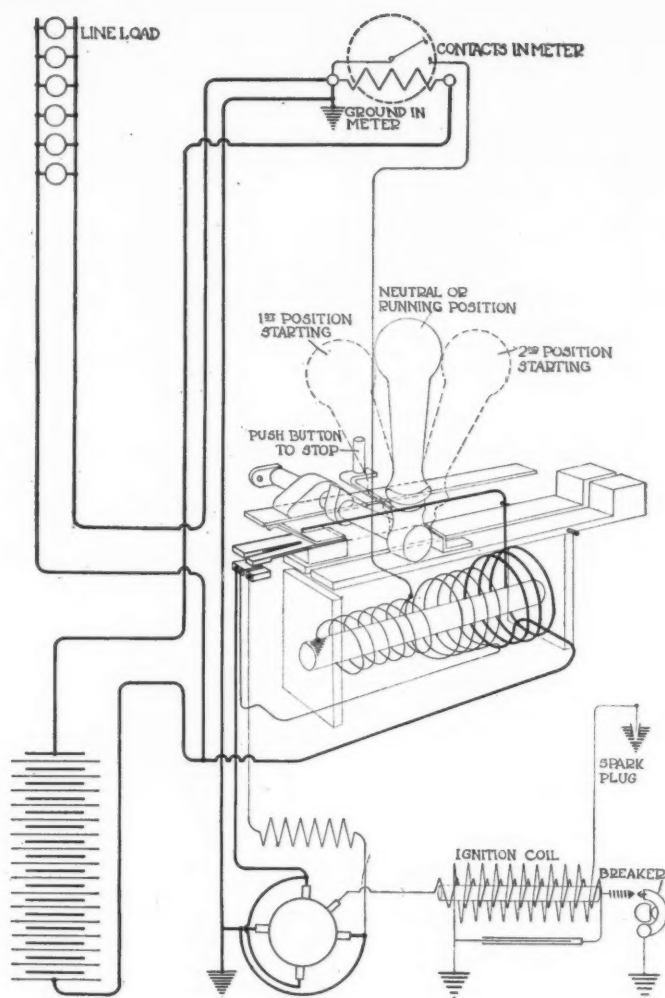
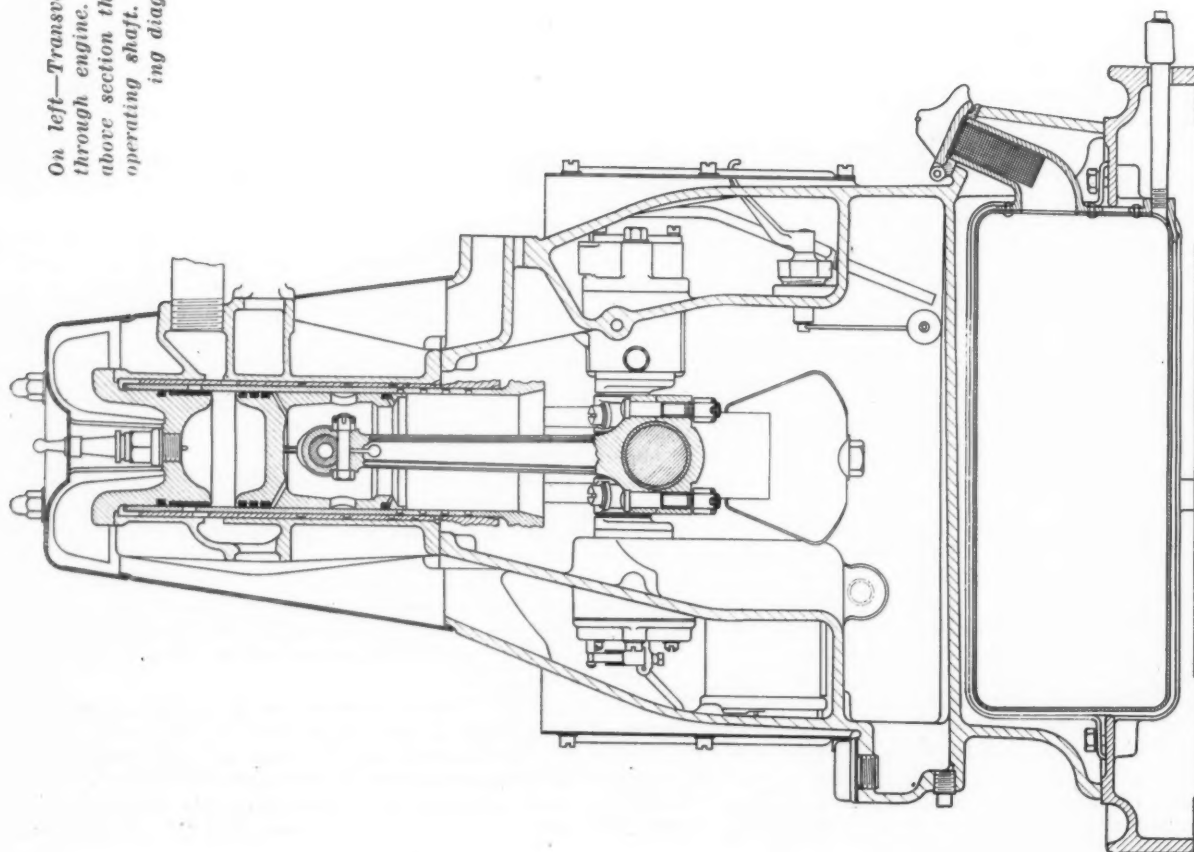
The ignition circuit is included between one of the main brushes and an auxiliary or third brush. In starting, the ignition voltage is 12, but owing to the armature reaction this drops down to about 3 volts while the engine is running. As the coil is in the base there is only a short lead from it to the timer.

When the batteries are fully charged the ignition is automatically cut out. The battery cut-out, manual starting switch and overload switch are combined in a single electromagnetic device. This carries three windings, one series and two shunt. The electro magnet also has two armatures arranged side by side, one of which carries the switch contacts for both the main line and the field circuit. Adjacent to this is another similar armature which serves merely as a magnetic shunt.

In starting, the switch contacts are brought together by means of the handle shown, which acts on the switch armature through the intermediary of a cam or lever mechanism. Later on the lever is placed in the neutral position and the switch is then subjected to electro-magnetic action on the one hand and to the action of a spring on the other. Nor-



On left—Transverse sections through engine. On right—above section through valve-operating shaft. Below—wiring diagram



mally the whole of the shunt winding of the cut-out switch is effective, and this, together with the series winding, holds the switch closed against the action of the spring. When the meter hand on the ampere-hour meter connected in the main circuit comes around to the "full charge" position it makes contact with a post on the face of the meter, with the result that one portion of the shunt winding of the cut-out switch is short-circuited, the magnetism of the electro magnet becomes too weak to hold the switch against the force of the spring and the switch opens.

The supplementary armature serves as an overload switch. If an extra heavy current flows through the main battery circuit, and consequently through the series winding of the cut-out switch, the magnet of the cut-out switch becomes so strong as to attract the supplementary armature. This then serves as a magnetic shunt, taking magnetic flux away from the other armature and causing the spring force to overcome the magnetic attraction on the switch armature, opening the switch. The electrical characteristics of the machine are such that when the engine is running up to its speed of 1,100 r. p. m., the voltage builds up and the current is sent out to take care of the line load. There is a surplus of 20 amp. not needed to supply the line, which goes through the ampere hour meter to the battery and charges it. With no load on the line, the battery is charged at the rate of approximately 20 amp., thus requiring about

9 hr. to charge at this rate. When the batteries are fully charged, the circuit breaker operates, cutting out the engine.

Regulation of the generator output is inherent. The storage battery floats on the line. A third brush is used to take off ignition current and must not be confused with the third brush used on variable speed generators for purposes of regulation.

The generator is distinguished by many features of up-to-date electrical construction. For instance, there are no brush wires, the leads to the brushes being strips of copper molded in Bakelite. The control box mounting is on the field frame, which gives a very compact layout. The unit complete weighs 350 lb. without the battery, and the battery weighs 52 lb. per cell. In mounting it is recommended that a concrete block installation be used, although this is not essential.

Production plans originally called for 30,000 output from Aug. 19, 1919 to Aug. 19, 1920, but the production will be limited by the material situation. The distributing organization is complete and deliveries are just starting. The country has been divided into nine sections and a district salaried officer appointed in each, these carrying the title of district salesmanager. In each of these districts there is also a service manager, a salaried employee, to supervise and systematize the service work. Practically the entire country has been closed on a quota basis.

A New Style Winter Radiator

IN the past, control of engine cooling has been effected by stopping or retarding the water circulation in the cooling system. This is generally accomplished automatically by means of a thermostat consisting of a bellows filled with a liquid evaporating at a low temperature. There are really two factors determining the rate of engine cooling, namely, the water cir-

culation and the air circulation. If the rate of air circulation through the radiator is reduced, other conditions of operation remaining the same, the engine temperature is inevitably increased. A device for automatically controlling the flow of air through the radiator in accordance with the cooling water temperature has been invented by Christian Nielsen of Chicago and is being manufactured by the Pines Mfg. Co. It is known as the Winterfront.

The device consists of a drawn steel shell fitting over the core of the radiator, and is attached by four bolts which pass through it. A braided cord edging forms a protecting cushion between the shell and the core of the radiator. The shutters are made of smooth steel and are ribbed for strength. The shutter trunnions are turned brass and work in composition bearings. They are arranged to operate in unison and are connected with the thermostat in the upper portion of the drawn steel shell by a linkage.

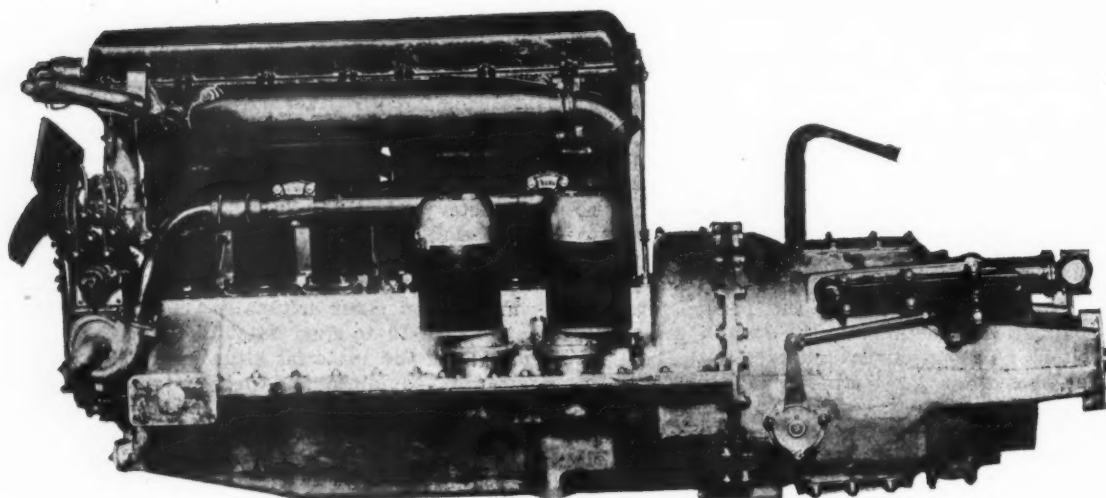
The thermostat consist of a pair of thermo-wafer cells, a spacer and an aluminum heat conducting plate. The thermo-wafer cells are of spring bronze and are filled with a liquid which expands and contracts with the temperature. The aluminum heat conducting plate is held flat against the radiator. On a cold day the Thermo-wafer cells are concave, the sides of the cells almost touching at their center. When the cells are cold the shutters are closed, and they are accordingly entirely closed on starting the car. They remain so until the radiator has warmed up to 130 deg. Fahr., when the heat is conducted by the aluminum flange to the thermo-wafer cells, causing them to expand. As the cells expand the shutters open gradually, to correspond with the requirement of the engine.



A Winterfront Radiator.

The Index

YOU will, of course, miss the semi-annual index in this number. If you want one, drop a letter or card to the Editorial Department, AUTOMOTIVE INDUSTRIES, 239 West 39th street, New York City, and one will be forwarded. The reason for the omission is explained on the editorial page.



Exhaust side 40 h.p. 6-cylinder, Lanchester Power Unit

New Features in 1920 Lanchester Model

This new model carries one of the few British engines having a direct feed to the wrist pins. The lighting dynamo and motor are mounted with their shafts vertical in order to save space. Interesting material presented for comparison with American models

A SIX-CYLINDER overhead valve engine, 4x5 in., has been adopted for the 1920 Lanchester car; one type of chassis will be used. The chassis price of the new English model will be £1,500 (about \$6,500) without bodywork.

It is supplied in two lengths of wheelbase, namely, 141 in. and 150 in., the track of both types being 58 in.

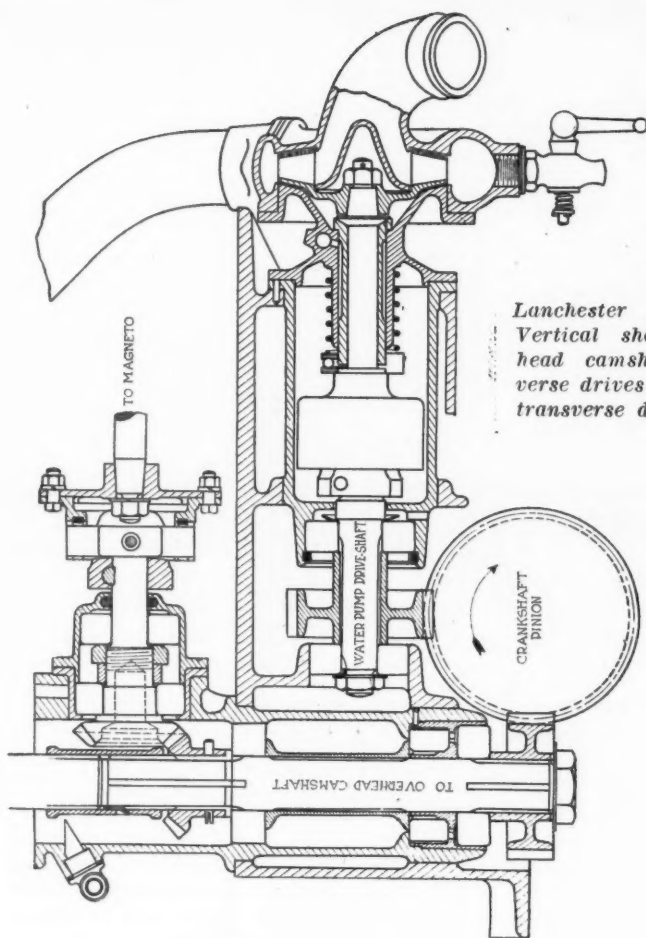
The engine has its six cylinders of cast iron with integral heads, arranged in blocks of three. The overhead valves are arranged at a slight angle from the vertical, the exhaust having its seat in the upper part of the combustion chamber, while the inlet is arranged in a detachable cage with a ground conical seat in the cylinder head. The exhaust valve is removed by taking away the inlet in its cage and drawing it through the hole. The valve heads are of the tulip pattern and the stems operate in phosphor bronze guides.

The overhead camshaft is driven by a vertical shaft and helical gears from the crankshaft, the valves being operated through rocking levers. Lubrication of the overhead valve-gear is assured by carrying a lead from the gear type oil pump to one end of the hollow camshaft, the oil finding exit through small holes to the cams, camshaft bearings and rocker bearings, the rocker levers being pivoted on a hollow

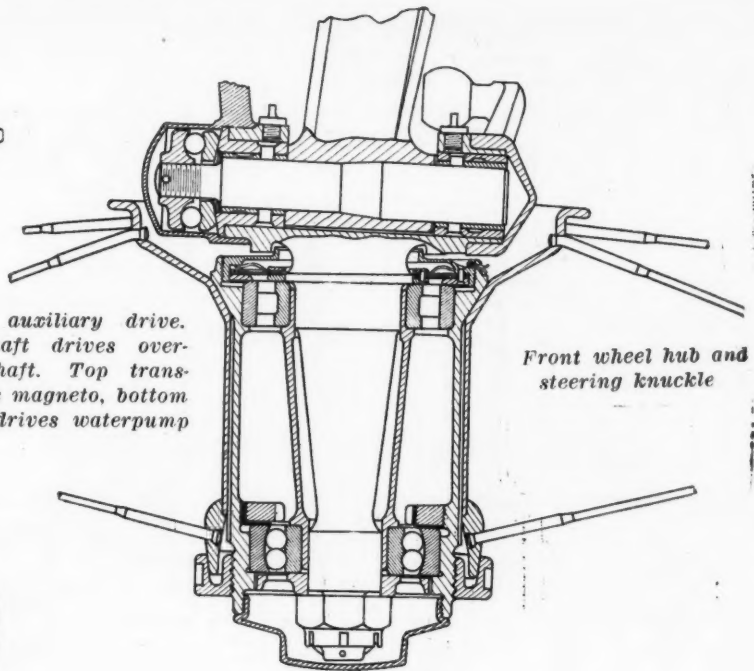
shaft. Surplus oil runs back into the crankcase after flooding a trough in which runs the larger of the topmost pair of helical gears.

Two transverse distribution shafts are located at the front of the engine, one being driven by helical gearing and serving to drive the centrifugal water pump through a spring coupling; the other driving the magneto through bevel gearing. A Remy ignition system is also provided, the distributor being mounted at the front end of the camshaft.

H-section connecting rods are used, with die-cast aluminum pistons having four rings. The hollow wrist-pin floats in phosphor bronze bushes in the piston bosses, being prevented from moving laterally by a split coned disc expanded into annular grooves in the piston bosses. The white metal liners are cast directly into the steel of the connecting rod big-ends, while the drilled crankshaft is supported from the top half of the aluminum crank case in seven white-metal lined bearings, the caps of which are of die-cast aluminum. Running parallel with the crankshaft, towards the rear end of the engine, is a layshaft driven by or driving the crankshaft through straight-toothed gearing. This layshaft serves three purposes: (1) To drive the oil pump by helical gearing; (2) to rotate the lighting dynamo, and (3) to form the drive-shaft for the separate starting motor. The helical

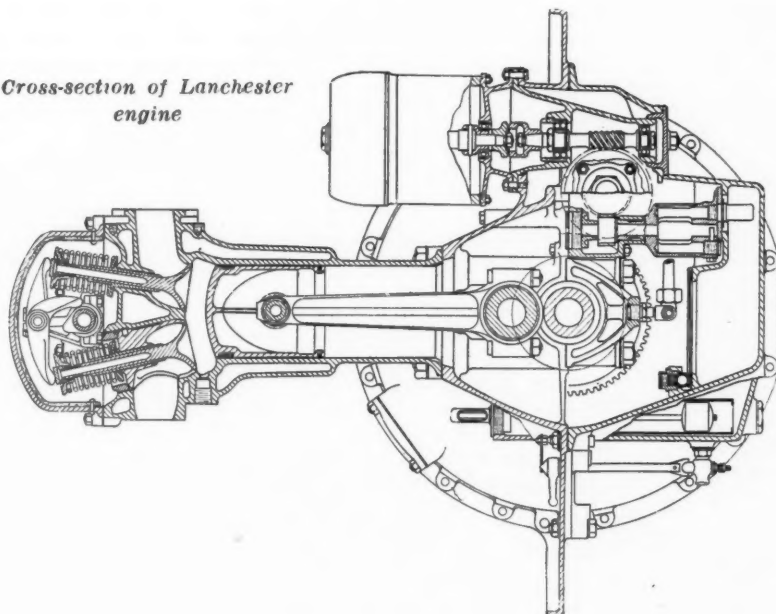


Lanchester auxiliary drive.
Vertical shaft drives over-
head camshaft. Top trans-
verse drives magneto, bottom
transverse drives waterpump

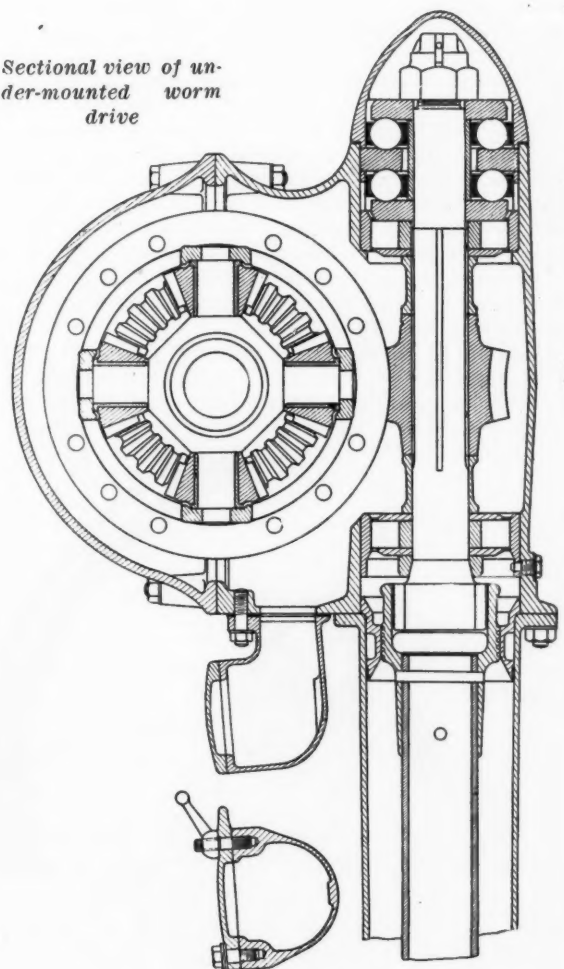


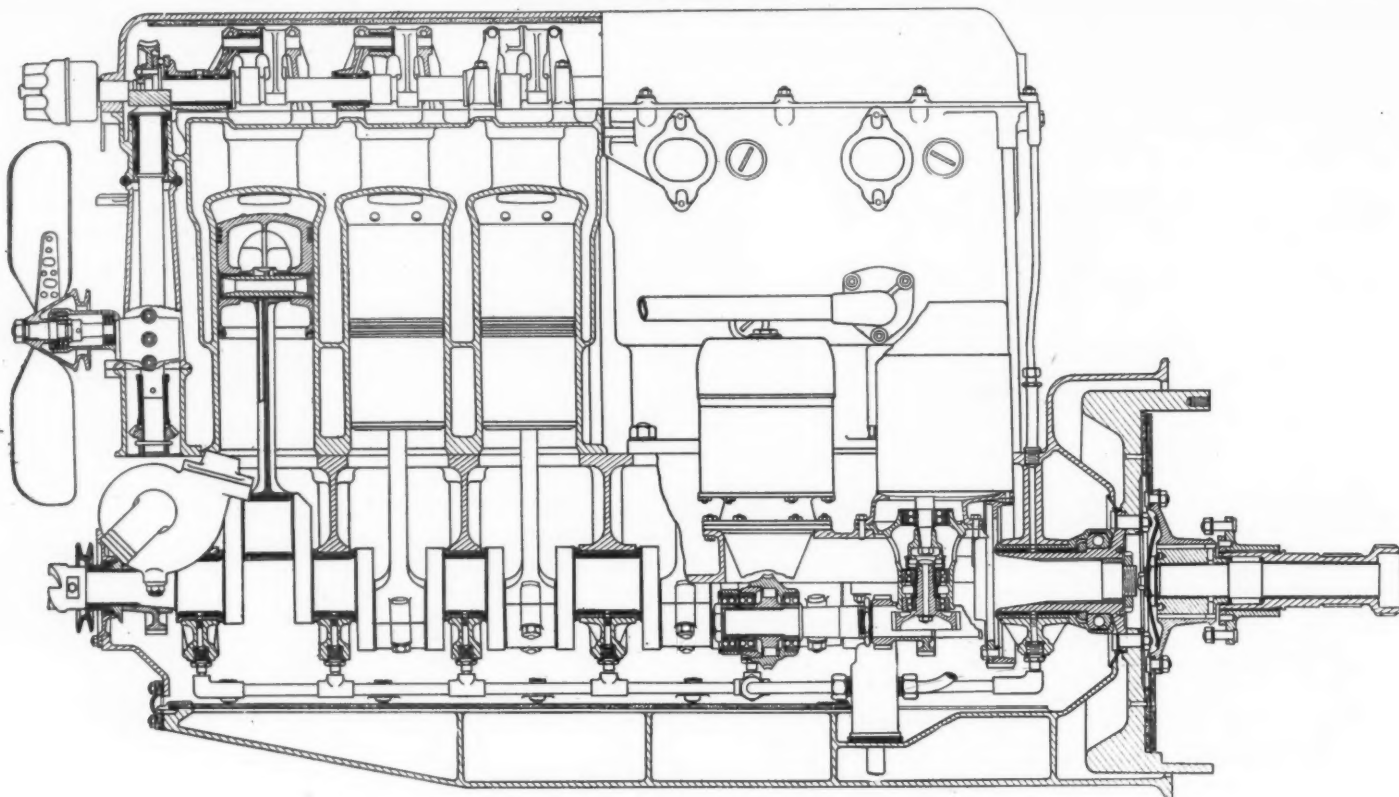
Front wheel hub and
steering knuckle

Cross-section of Lanchester
engine



Sectional view of un-
der-mounted worm
drive





Side sectional view of Lanchester engine

gear pinion on the motor shaft has a free wheel or over-running clutch so that the motor armature is stationary except when engine starting is in progress. An unusual feature of the lighting dynamo and the motor is that they are mounted with their shafts vertical, the idea being to save space, while it also renders the brushes slightly more accessible.

Engine lubrication is maintained by the gear pump delivering oil through a gallery to the main crankshaft bearings and through the drilled crankshaft to the big-ends. This is one of the very few British engines having a direct feed to the wrist-pins, tubes being attached to the connecting rods and running from the big-ends upward. A large oil filter tray covers the whole of the sump, and can be withdrawn for cleaning purposes from beneath the radiator without disturbing any other part.

Lanchester Motor Company cars have always been fitted with planetary gearing and the new model forms no exception, the gearset providing three speeds forward and a reverse. A clutch pedal and gear lever, the latter on the

its own oil pump with direct feeds to the main bearings. The high gear is a direct drive, while the usual brake mechanism obtains for the other gears, the means of adjustment for the bands passing through the casing to external thumb-screws.

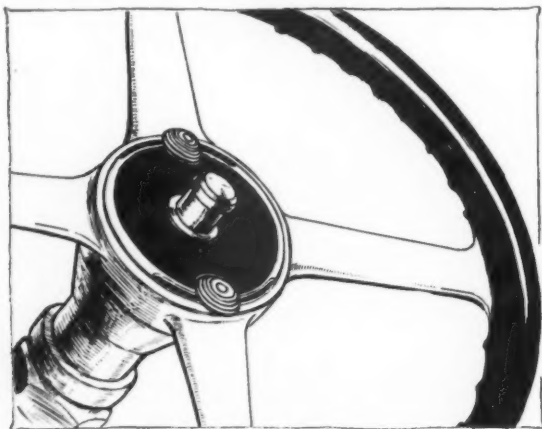
At the rear of the gearset is an internal expanding type brake with a ribbed drum, behind this again being the casing of the propeller shaft universal joint. This casing is bolted to a deep cross member of the frame and supports the spherical head of the torque tube.

The Lanchester type worm lies below the back axle, which is of the full floating type, despite the favor with which the semi-floating axle was viewed by the Lanchester company before the war. The rear axle bearings consist of parallel rollers and a ball thrust at each side of the differential, while the wheels run on a double ball-bearing and one of the parallel roller type.

Steel pressings are used for the torque tube and also for the differential casing and axle tubes. The outer ends of the driving axles have teeth formed on them to engage with serrations in the hub shell, the joint being pulled up onto a taper and secured by a nut and locking ring. Expanding brakes occur at the rear, where the suspension is of the cantilever type, the rear end of each spring resting in a housing between roller bearings. To take up lateral wear and prevent rattle, the rollers and the spring end are held up against the outer face of the housing by a volute spring. The roller housings are fed with lubricant directly from the rear axle.

The main frame of the chassis is, as usual, of pressed steel. A reversed channel liner, bored with large holes to reduce weight, extends inside the main channel from the front bearer arms and the engine back to the cross member behind the gearset. There is a tubular cross member of unusually large diameter towards the rear end of the frame, the extremity of the latter supporting the fuel tank.

The steering gear consists of right and left hand threaded screws on the column, engaging with nuts which bear against rollers on the ends of a rocker secured to the shaft of the steering arm. The rake of the column is adjustable within a bracket carried on the aluminum dashboard, which is hollow to form an air and heat insulating space between the engine and the front seat compartment.



The Lanchester steering wheel

right, are provided, and the operation of changing gear is carried out as in cars with the usual selector type transmission. The clutch is of the single plate type and is contained within the transmission casing, which also embodies

Solving the Problems of the Railway Motor Car

After meeting the common objections to the use of motor cars as a part of short line railway equipment, Mr. Hampson points out by mathematical formulae the possibilities and limitations of the motor truck when converted to railway use. He presents an interesting solution to the problem of fulfilling the requirements of a railways run which has difficulty in meeting expenses

By Donald A. Hampson

AT this time, when everything that goes to make up operating costs has reached a figure hitherto undreamed of, and when there has been no proportionate increase in rates and very little increase in traffic, the officials in charge of branch lines and short independent railroads are scanning the field for some other method of operation than with their existing equipment, having in mind some type of self-propelled single car that could be secured at reasonable cost to relieve the steam trains of unprofitable trips. The problem is quite similar to that of the electric roads in second and third class cities, serving also the surrounding villages. Many of the railroads in these two classes do a good two-months' business in the summer, but during the rest of the year the passenger business is run at a loss even with schedules reduced as much as the public and public service commission will permit.

Electrification, once hailed as the panacea, is out of the question at the present time. What, then, of the gasoline engine? Loaded ten-ton trucks moving at a moderate speed, one-ton trucks making thirty miles an hour, crowded auto buses bowling along merrily at the same rate—all operated

and steered through the streets by one man—no perplexed official can see these without at least asking himself the question, "Why not, on the railroad?" The officials know of the gas-electric cars in operation; but these cars are as heavy as the coaches it is desired to eliminate, the first cost is of the same order as that of a locomotive, and the running expenses are higher than the figure the road is trying to meet.

If pressed for a reason as to why flanged wheels are not substituted for the rubber tires on one of these motor trucks or buses, operating so successfully over the streets, the person questioned would probably reply that they are "too lightly built for railroad work," or that they are "too expensive to keep up." But in spite of these objections, the allurements of the motor vehicle persists, and so does the brutal fact of steam trains carrying a total of, say, twenty passengers, or of the morning operation of thirty-ton electric cars for the accommodation of half a dozen persons per trip.

Before relating the experience of one short line railroad with converted automobile equipment, it will be well to classify the objections to and the limitations of such equipment for general adoption; also to make some comparisons with present rolling stock, to submit data as to conditions which the railway motor car must meet, and to make suggestions for improvements, which actual use have shown.

The chief objections raised against motor cars are:

- (1) Winter operation is difficult for the engine and uncomfortable for passengers.
- (2) The gears and clutch so necessary are too delicate for steady use by ordinary labor without excessive upkeep charges.
- (3) Too light construction for service on metal rails.
- (4) Cars must be turned at the end of every trip. These objections are taken up in order, and where found valid, remedial steps are given.

WINTER OPERATION

Cold weather, while not an ideal condition for gasoline engines, has not been found so much of a drawback as is commonly supposed. Thousands of businesses have dispensed with their horses and now use motor truck fleets the year around. Many of our northern cities have completely motorized their fire departments and more are doing so—if there was any serious objection to thus depending on gasoline, fire underwriters would take measures to lessen this

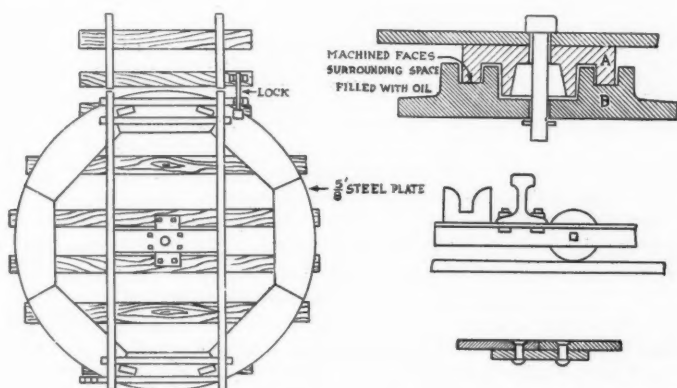


Fig. 1—Plan of turn table

Fig. 1C—Top—Section through pivot bearing (parts A and B are center bearing casings)

Fig. 1A—Center—Partial
Fig. 1B—Bottom—Detail of joint in circular track end elevation, showing lock, rail fastening and rollers



Motor Car fitted with flanged wheels but retaining its steering gear to permit it of turning around at ends of line



Passenger Car fitted with flanged wheels and serving as inspection or official's car

"risk" at once. For years gasoline locomotives have been operating successfully in such exposed locations as quarries and mines, logging, industrial, and construction work that is carried on all winter. There is nothing in railroad work more severe than the cases which have been named, and no reason to expect any poorer results if the same precaution is taken of housing the machine over night where the temperature is below freezing.

In the matter of comfort to passengers, we have the heat of the exhaust which is undoubtedly susceptible of more service than has been exacted from it in the past in automobile work. There are also heaters for small cars that have proven efficient, and economical enough to warrant their adoption in electric cars in place of the resistance coils supplying heat from the line.

GEARS AND CLUTCH

Because the gasoline engine is efficient only within a limited speed range, its use as a prime mover must include either a "friction drive" or a clutch with change gears. Neglecting the friction drive, we hear much in regard to the wear and tear on gears and clutch. In reality, this has not been found a big item of expense in road work and there is no reason why it should be a larger proportion in railroad service.

Motor truck transmissions have been constantly improved where experience has shown a need for improvement and greater strength. With a serious-minded driver, years of service can be obtained from modern construction. A careless man will damage any kind of machine, be it automobile or locomotive. Wear and tear of parts comes from clashing of gear teeth in speed changing, harsh engagement of the clutch or engagement following premature shifting to higher speeds, and changing from higher to lower speeds.

But railroad service offers two forms of relief through which the mechanism of the converted motor truck is guarded from some of the evils of gear changing: (1) If the engine is powerful and the speeds are changed too fast for the car's acceleration, the wheels will slip, something they would not do under similar conditions on a highway where the adhesion is greater, and (2) if the load is too great or imposed too suddenly on the engine, the engine stalls ("you can't overwork a gasoline engine—if you do try, it kills itself and stops," is a common expression). So thoughtlessness on the part of the driver is met in part, not by breakage, but by a failure to function which brings him to his senses, just as the flying out of the circuit breaker warns the motorman that he is feeding too fast.

The driver should make a better record on rails than on the road. There is no steering to do, and there being no traffic and no pedestrians to dodge, there is no need for the lightning spurt that sometimes means safety in the street; in fact, there is nothing to distract the driver from doing quick, clean work at each start.

However, granting that carelessness in building up speed will produce ultimate trouble, there are several things that have been done and that might be worked out to compel rational gear shifting and acceleration. A temptation to men who have driven automobiles is to start on high or to shift from low directly to high when an apparent easy start is to be made. This can be done successfully, but it is almost sure to impose stresses and to shorten the life of vital parts. One way to combat such habits has been found by fastening a latch on top of the transmission case, that keeps the shift lever from going into high unless the shift is made from the second, or intermediate position. This compels progressive gear changing.

With some of the progressive type transmissions in use a few years ago it was impossible to let in the clutch until each gear shift had been fully made. It is the author's belief that the progressive transmission is better than the selective for motor cars and trucks, since it practically guarantees one-two-three shifting, which is the only safe way to start a load.

Progress may develop a governor driven by the propeller shaft and either electrically or mechanically actuating a lock which prevents engaging any gear until the car has attained a speed previously determined as the safe minimum for that gear. Going a step further and sweeping aside all necessity for co-ordination between hand and foot in gear shifting, a simple design of shaft and cams would perform the clutch and gear movements with precision leaving the driver with a manually operated hand wheel that could be turned only at a rate in accord with the speed of the car.

LIGHT CONSTRUCTION

The gasoline motor car is the lightest piece of rolling stock on our railroads. Consider a car seating thirty people, its dead weight is but a little over 200 lb. per passenger as against an average of 1,200 lb. for a double truck street car and 2,000 lb. and upward for a locomotive and single coach. In proportion to the horsepower of the engine, the light locomotive and the motor car each move approximately the same amount over the rails, while the street car does nearly twice as well. Table 1 gives some comparisons.

Self-evident reasons have compelled engineers to keep gasoline vehicles for road use down to the lightest weights; this has been achieved by skillful designing and the introduction of the highest grade of materials; the rubber tire has aided materially in the effort for lighter weight. Undeniably this pruning has been carried too far for economical maintenance of the same vehicles equipped with metal wheels and pounding over rail joints, but the rigors of railroad work are taken entirely by the wheel mountings, axles, and axle bearings; other parts of the machine suffer no more than at the same speeds and loads on highways.



Dual acting as trailer on each trip

Relief for constructions that are too light is not hard to obtain. The front axle with its pivoted wheels is changed to a rigid axle or, better, to a pony truck; necessity for flexibility to make curves passes with railroad work. The rear housing may be altered to take larger axles and bearings or the axle assembly may be turned into a jack-shaft with sprockets chain-driving a heavier axle carrying the wheels. A chain drive motor truck has this latter change already half made. In making rear end changes, it is well to remember that the equalizing, or differential, gears are superfluous on the railroad and the space thus saved may be utilized for more rugged construction.

Table 1

Car	Seating Capacity	Lbs. dead weight per Passenger	H. P. of motor
¾ ton gasoline.....	16	250	27
3½ ton gasoline.....	40	250	40
28 ton electric.....	40	1,400	160
30T. Ry. Coach and			
30T. Locomotive	60	2,000	320

REVERSING AT TERMINALS

Gasoline locomotives are made with either friction discs or dual gear boxes by which the forward speeds are duplicated in reverse direction, but the motor car is a one direction machine like the locomotive and as such must be turned at the end of every trip. True, there is a reverse in the gear set but that is so slow as to be of no value except in switching.

A turntable must be provided at terminals. On steam roads that add motor car auxiliaries, the existing facilities are used. Where none exist, a turntable may be placed at the end of any short siding. Such a turntable may be constructed at slight expense by following the design shown in Fig. 1. Intended solely for motor car use, this turntable is heavy enough for 3½ ton cars; the driver can make the turn in two minutes and be off in the reverse direction. Quite naturally, other rolling stock must be kept from passing on this section of the line. The drawing shows the turntable built upon ties—if a more permanent construction is desired, a concrete foundation for the center bearing and the track may be put in.

The Y of the steam road is not satisfactory because its length wastes so much time on the slow reverse speed of the car. With motor car limitations in mind, a Y could be laid out that would be short and quick—a pair of worn out street railway curves from a T shaped intersection of streets has made a very satisfactory Y for the motor car. When a Y can be located so there is no long period of backing to or from it, it has advantages over the turntable, i. e., a fixed installation, no attention required, driver can turn without getting out.

Physical conditions make the turntable more desirable in a majority of new installations. When of the design suggested, they occupy little space and may be most advantageously located. Where no other arrangement was possible, track turntables that fold out of the way and are locked when not in use, leaving the track ready for through traffic, have been used.

One steam railroad overcame the necessity for turning at its last station by utilizing the two per cent grade leading up to that station (this being a side hill meeting point with a trunk line). Half a mile back, on the flat, there was the Y used by the locomotive. After the motor car had discharged passengers at the junction, the engine was given a good "kick" while in reverse gear and this was sufficient to send the car back by gravity to the Y where the turn was made.

To determine the possibilities and the limitations of a given motor truck which it is desired to convert to railroad service, calculations may be made through the usual formulae of gasoline engine practice and railroad engineering. The turning moment of the engine may be calculated as tractive effort at the rails, a force which is used in overcoming the resistances of load, grade, curves, friction, and some others. Knowing these various factors, it is possible to estimate within reasonable limits just what kind of performance may be expected from a machine of known size and weight. Exact results are, of course, only obtainable from actual trial or from calculations based upon laboratory tests, since otherwise the mechanical and thermal efficiency must be assumed according to the averages of standard practice.

The formulae which have been selected are those which seem best adapted to the work under consideration. In the case of the engine formulae, it may be said that they represent conservative practice (at least while the engine is kept in good running condition) for makers are prone to claim that the N. A. C. C. formula for horsepower underrates their machines.

POWER FORMULAE

- $$(1) \text{ H.P.} = \frac{B^2 \times N}{2.5}$$
- $$(2) T = \frac{\text{H.P.} \times 5250}{S}$$
- $$(3) \text{ D.B.P.} = \frac{5.18 \times B^2 \times L \times N \times R}{D}$$
- $$(4) \text{ T.E.} = \frac{T \times R \times E \times 2}{D}$$

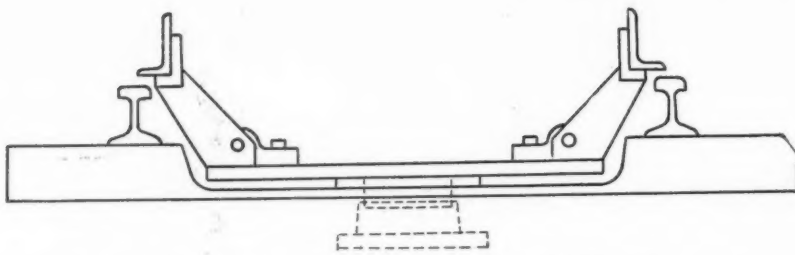


Fig. 2—End elevation of turn table raised to working position

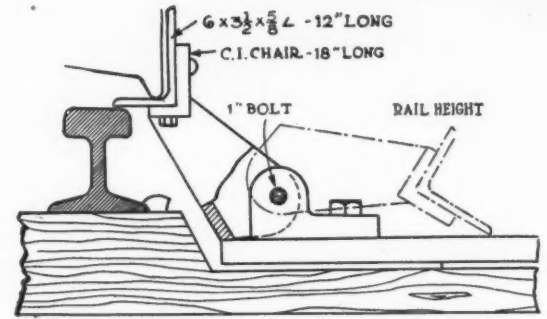


Fig. 3—Details of folding parts

In which the various characters have the following meanings:

H.P. = brake horsepower,
T = torque in foot-pounds,
S = R.P.M. of the engine,
B = bore of cylinder in inches,
L = the stroke length in inches,
N = number of cylinders,
D = diameter of wheels in inches,
R = total gear reduction,
T.E. = tractive effort in lbs.

Formula (1) is, of course, based on an assumed piston speed of 1000 ft. p. m. and a mean effective pressure of 90 lb. per sq. in.

There is a distinction between draw-bar pull and tractive effort, under certain conditions: Draw-bar pull is the ability to produce transportation energy as distinguished from tractive effort, which is an expression of power at the circumference of the driving wheels, but in so far as the user of railway motor cars is concerned the terms are synonymous as long as the tractive effort is not greater than the weight on the drivers times the tractive efficiency. Formula (3) will appeal to a prospective user because from it he can compute what may be expected from a given machine by reference to catalog specifications.

Naturally the tractive effort (draw-bar pull) is greater when using the greater gear reduction ("low") than when using "high." The diameter of the wheels is a direct measure of tractive force and there might be a temptation to use smaller wheels to take care of possible heavy loads. This, however, should be done advisedly, in view of the risk of engine overheating from continued running at speeds too high for the cooling system supplied.

RESISTANCES

These may be divided into (1) train resistance, also called speed resistance, (2) the resistance of starting, (3) grade resistance, and (4) the resistance of curves.

Briefly, train resistance includes the resistance to rolling as well as the wind resistance and that of the moving parts of the machine. This resistance is commonly assumed as slightly greater for a locomotive (self propelled) car than for a trailer, chiefly on account of head end resistances; some authorities give these resistances a rapidly increasing value for single car operation at higher speeds. Davis states that the speed resistance of a single car at 35 m.p.h. is equivalent to that of a 1 per cent grade. This, however, has not been borne out in the operation of gasoline motor cars. The resistance at starting is high; it drops to a minimum at about 6 m.p.h. after which it gradually rises. A formula well adapted to train, or speed, resistance is

$$R = 5 + .004 \times V^2$$

in which R is pounds per ton of weight and V is velocity in miles per hour. Roughly, uneven track causes a marked increase in R; so also does the usual narrow gage track, but for railroads already using standard gage steam or electric rolling stock, the formula is a good average.

At the instant of starting, the resistance is higher than given by the formula—it may run as high as 40 lb. per ton of weight, though it is customary to assume it to be 16 lb. per ton with well kept-up equipment. Some scale readings taken with motor trucks applied to railroads showed the resistance at starting to be 16½ lb. per ton.

In ascending a grade, the car has to be raised an amount equal to the grade, in addition to being moved longitudinally. Power to do this must be supplied by the prime mover and is an added load. The common method of expressing grades being that of percentage, the work of ascending them is computed on this basis and is always 20 lb. per ton for each per cent of grade.

The friction of the wheel flanges against the rails and the axle thrusts produce a resistance in rounding curves. Except in the case of street railways, curve resistance is light; it is customary to assume curve resistance as from 0.5 to 1 lb. per ton of each degree of curvature with 0.6 lb. as a satisfactory value for light cars. The increase due to the long wheel base of railway motor cars is offset by the more efficient means of absorbing and thrusts.

Summing up, we have these resistances to consider:

Speed— $5 + 0.004 \times V^2$ lb. per ton.

Grade—20 lb. per ton for each per cent of rise.

Curve—0.6 lb. per ton per degree of curve.

Also the resistance of starting—16 lb. per ton.

Motor trucks of to-day should deliver from 70 to 80 per cent of the power of the engine at the circumference of the wheels. This is power delivered regardless of the medium upon which the wheels roll. The adhesion of rubber tires on dry roads is as high as 75 per cent to 85 per cent, a coefficient unattainable by metal wheels on steel rails. In railroad work, the maximum adhesion has been placed at 33 per cent while experience has placed the working limit at 25 per cent. In other words, not more than 25 per cent of the weight on the driving wheels can be utilized in propulsion. It matters very little whether that weight is distributed over one or more pairs of drivers.

That value, 25 per cent, is often called the "coefficient of friction." The coefficient of static friction is quite different from that of dynamic friction. The experiments of Galton and Westinghouse showed that the coefficient of static friction of a wheel just moving was 0.330; at 5 m.p.h. it was 0.273, and at 20 m.p.h. it was 0.192. Just as it is important to prevent slipping the wheels when accelerating, so it is of importance in braking; when wheels skid, their contact surface with respect to the rail, and the resistance which they

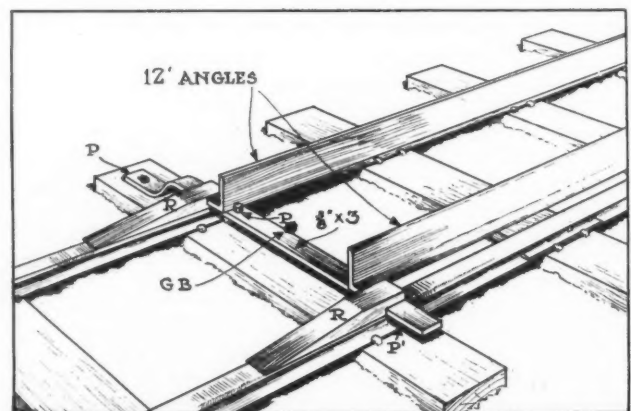


Fig. 4—Guide bar used to lock table for on and off running

can be made to oppose to the motion of the car, is a product of the weight times the coefficient of (dynamic) friction. If the wheels be controlled to the point where they do not skid, then their resistance to the motion of the car is a product of the weight times the coefficient of static friction—a value from a third to one-half greater than the former. In connection with these facts, it is plain why the driver of the rail motor can secure greater braking efficiency by not disengaging his clutch.

An application of the foregoing formulae and rules will be made from the following data. Given a motor truck having a 4-cylinder engine, $4\frac{1}{8} \times 4\frac{1}{2}$, with gear ratios of $3\frac{1}{2}$ to 1 on high gear and 13 to 1 on low, equipped with a 25 passenger body, the total weight empty being 4900 lb., loaded, 9,000 lb. of which 5,500 lb. is on the rear wheels. This machine it is desired to operate over a standard gage railroad in fair condition; the maximum grade is 2 per cent, this occurring on a curve of $1\frac{1}{2}$ deg. and it happens that stops must be made on this grade. Driving wheels are 30 inch.

The engine should develop

$$\frac{4\frac{1}{8} \times 4}{2.5} = 27 \text{ H.P.}$$

This equals a torque of

$$\frac{5252 \times 27}{1370} = 103 \text{ ft. lb.}$$

at the maximum required speed of 35 m.p.h. The D.B.P. on high gear is

$$\frac{5.18 \times 4\frac{1}{8} \times 4\frac{1}{2} \times 4 \times 3\frac{1}{2}}{30} = 185 \text{ lb.}$$

The D.B.P. on low gear is

$$\frac{5.18 \times 4\frac{1}{8} \times 4\frac{1}{2} \times 4 \times 13}{30} = 702 \text{ lb.}$$

The resistances encountered on the grade are, of course, greater than those encountered on tangents and level stretches of track, so that the amount of the resistances at this point is the value which must be compared with the tractive effort of the machine in determining whether the latter has sufficient power, plus a safe margin, for the work it will be called upon to do. The resistances will be calculated for 30 m.p.h., 10 m.p.h. and for starting, these three covering typical conditions of operation.

At 30 M.P.H.—

$$\begin{aligned} \text{R. due to speed} &= 5 + 0.004 \times 30^3 \times 4\frac{1}{2} = 38.7 \\ \text{R. due to grade} &= 20 \times 2 \times 4\frac{1}{2} = 180. \\ \text{R. due to curve} &= 0.6 \times 1\frac{1}{2} \times 4\frac{1}{2} = 3.9 \\ \hline \text{total} &= 222.6 \text{ lb.} \end{aligned}$$

At 10 M.P.H.—

$$\begin{aligned} \text{R. due to speed} &= 5 + 0.004 \times 10^3 \times 4\frac{1}{2} = 1.8 \\ \text{R. due to grade} &= 20 \times 2 \times 4\frac{1}{2} = 180. \\ \text{R. due to curve} &= 6 \times 1\frac{1}{2} \times 4\frac{1}{2} = 3.9 \\ \hline \text{total} &= 185.7 \text{ lb.} \end{aligned}$$

At starting—

$$\begin{aligned} \text{R. due to start} &= 16 \times 4\frac{1}{2} = 72. \\ \text{R. due to grade} &= 20 \times 2 \times 4\frac{1}{2} = 180. \\ \text{R. due to curve} &= .6 \times 1\frac{1}{2} \times 4\frac{1}{2} = 3.9 \\ \hline \text{total} &= 255.9 \text{ lb.} \end{aligned}$$

Comparing these results with the draw-bar pull of the engine as computed above, we note that the total resistances at 10 m.p.h. just equals the D.B.P. on high gear, showing that there is sufficient power, but no margin for adverse conditions; however, as the grade in consideration is preceded by a long level tangent, there is abundant opportunity to gather momentum which will furnish the desired margin. At 30 m.p.h., the engine is not sufficiently powerful to carry over the grade on "high," except as advantage is taken to speed up on the approach—the two lower gears in the transmission would take care of any unlooked-for conditions. At starting, the resistances are the greatest—nearly 50 per cent more than the tractive effort on high—and of course the "low" gear is used; referring to the solution of the formula for draw-bar pull on

low, we note that there is available nearly three times the amount required for starting.

The element of doubt appears in the matter of starting—whether the power of the engine can be realized at the rail for traction purposes. But the weight on the rear wheels being 5,500 lb., there is available one-fourth of this, or 1,375 lb., which is practically double the greatest effort of which the engine is capable—showing that the machine is safe against slipping.

Another application of the same formulae was made in the case of an electric railroad which wanted to apply a motor car of the same engine and gear sizes as above but lighter. In this case the crucial test was a curve of 60 ft. radius that was also on a 7 per cent grade. Up this grade, the car must run at 5 m.p.h., oftentimes light except for the driver. The resistances at the point are:

$$\begin{aligned} \text{R due to speed} &= 5 + 0.004 \times 5^2 \times 2 = 5.2 \text{ lb.} \\ \text{R due to grade} &= 20 \times 7 \times 2 = 280. \text{ lb.} \\ \text{R due to curve} &= 0.6 \times 96 \times 2 = 115.2 \text{ lb.} \end{aligned}$$

$$\text{total} = 400.4 \text{ lb.}$$

This shows that the resistances in rounding this curve on the grade are more than double the D.B.P. on high gear and that it will be necessary to drop back to a lower gear with its greater propelling power. (As a matter of trial after the equipment was installed it was found possible to successfully negotiate this point on high gear by utilizing the momentum of the car in approaching the point—but no one would expect this type of gasoline propelled vehicle to run far on direct drive at five miles an hour.) The weight of the car is 4,000 lb. and a 60 ft. radius is a curve of 96 deg.

COST OF OPERATION

Cost of operation varies, just as it does with other types of rolling stock. As a one man car, the railway motor car requires an alert, intelligent driver with some mechanical ability and with at least a working knowledge of automobile operation. Such a man does not have to be in the locomotive engineer's class of pay, though it is obvious that a competent man is worth more than one of the indifferent class who may each day do damage amounting to many times his pay.

Mileage per gallon of gasoline should show a gain over the same machine on the highways, because railroad grades are extremely light in comparison. The two instances on which the foregoing calculations were based bear this out. The cars, or "buses," run over the steam road first mentioned cover from 150 to 180 miles per day with a gasoline consumption of 15 to $15\frac{1}{2}$ miles per gallon. The electric railway is a trolley of the average type, running between two points having a difference in elevation of 120 feet with the heaviest travel on the up trip; generally, the line crosses the drainage, so there are numerous grades, but the round trip of 14.4 miles is made at the rate of 18 miles per gallon of gasoline, with the running time of one hour.

Motor oil consumption is practically the same as in road work while the general oiling and greasing will probably amount to more, due to the railroad habits of plenty where bearings are concerned. The matter of repairs, or mechanical upkeep, is apt to show an increase over road work, chiefly because of the lesser familiarity with gasoline engine operation on the part of the railroad driver and because of the lack of the cushioning effect of rubber tires. By far the biggest repair items that the author has observed are due to overloading, and the honors seem to be equally divided between the highway vehicles and the same ones operating upon railroads. The item of tires—always a heavy one for motor trucks—entirely disappears when railroad wheels are applied.

The accompanying illustrations show various motor cars in service. One is hardly more than an official's or inspection car, but, as may be seen, has all the comforts of winter road motoring; this car is equipped with demountable flanged rims interchangeable with the regular pneumatic tires—so arranged, the car may be used in either service in the hour's time required for changing; the steering gear is left undisturbed and requires but a steady hand at forty miles per hour over the rails. Another photo shows a 25 passenger body mounted on four flanged wheels. The illus-

(Continued on page 28)

How to Prevent Torsional Vibration In the Crankshaft

Navy men present results of their experience to automotive engineers at December meeting of S. A. E. J. F. Fox discusses construction of Diesel engines and troubles developed during tests, while the mathematical theory of torsional vibration is taken up by Prof. F. M. Lewis.

By P. M. Heldt

THE December meeting of the S. A. E. Metropolitan Section, held at the Automobile Club of America on the evening of Dec. 18, two papers were read on the subject of torsional vibration in crankshafts and how it can be prevented. Experience with Diesel engines designed for use on submarines, formed the basis for the papers. These engines are of the 8-cylinder all-in-line type, and in addition have two air compressor cylinders at the front end so that the crankshaft is of unusual length. The engines had to be put through a series of specified tests which included one long duration test under a load of 700 horsepower at 350 r. p. m., and when it was attempted to put the engine through this test, it vibrated so violently that it was soon seen that the test could not be completed.

The proceedings of the evening were in a way directed by Lieut.-Commander W. H. Pashley, who has charge of Diesel engine construction at the New York Navy Yard. One of the papers, read by J. F. Fox, dealt with the constructional details of the engines and the troubles that developed during the tests, as well as with the manner in which these troubles were overcome by the use of the Lanchester vibration damper. The other paper was by Prof. F. M. Lewis, of Webb's Academy of Naval Architecture, New York, and dealt more particularly with the mathematical theory of torsional vibration in shafts. A large audience heard the two papers read and a lively discussion followed. Lieut.-Com-

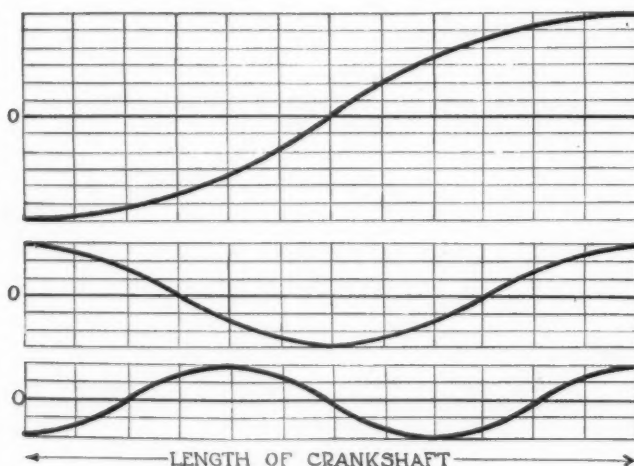
mander Pashley, in introducing the speakers, said that the navy had drawn on the automobile field for some of its inspirations, and they were pleased to present some of their experiences to the automotive engineers.

Mr. Fox in his paper said that a certain amount of vibration was very apt to occur in engines having six or more cylinders in line. The crankshafts of such engines are quite long, and naturally very flexible, and the torsional vibration is always due to the coincidence of impulses with the natural vibration of the shaft. In the submarine engines the vibration was especially severe at both ends. At the rear end there was a coupling by which the engine was connected to the generator. This coupling consisted of a pair of spur gears, secured to the adjacent ends of the engine shaft and generator shaft, respectively, an internal gear being arranged over the two so that it could be slipped endwise and form a convenient means of coupling and uncoupling the generator. Owing to the vibration of the engine, the two adjacent members of the coupling would be thrown out of line, and as a result, friction would be generated, which caused the internal members to expand to such a degree that it was impossible to move the external member.

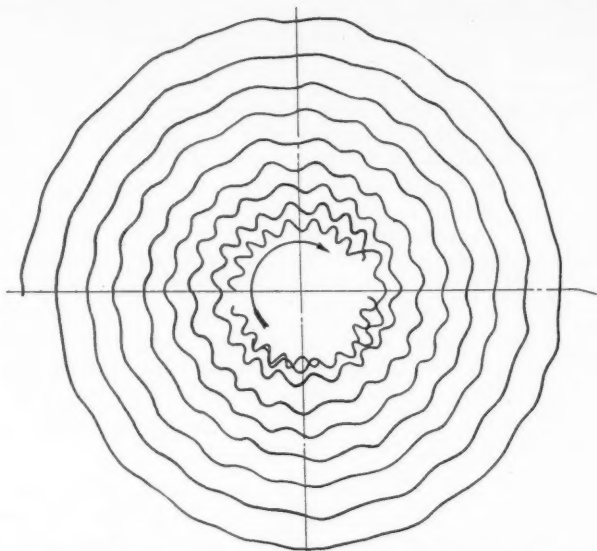
To overcome the trouble, a Lanchester vibration damper was fitted to that portion of the crankshaft protruding from the forward end of the engine. This damper consisted of a flywheel 36 in. in diameter and weighing 1,000 lb., which was held frictionally between two plates covered with friction material, which were in driving connection with the crankshaft. While this damper stopped the vibration, it was seen after a few hours run that the friction surfaces were subject to considerable wear, and would not last more than a few hundred hours at the most. Moreover, the adjustment on the friction surfaces had to be rather close.

The next step was the design of a regular dry disk type of clutch, which placed the vibration damper in driving connection with the crankshaft. The idea was to reduce the pressure per unit of frictional surface, and thus increase the life of the material. The metal disks of the clutch were formed with driving keys, one set having these keys on the outer and the other set on the inner circumference. Naturally, these keys had to be made so as to fit loosely in the corresponding keyways, and after this clutch had been in service for some time there was found to be a certain riveting action on the keys. The riveting or upsetting action, of course, increased, as the looseness at the keys increased, and it was soon found that this was not a satisfactory design.

In the final design, which has proven entirely satisfactory, the damper is made with a very thick web, in which holes



Curves illustrating primary, secondary and tertiary vibrations of a shaft



Crankshaft motion record traced by tuning fork

are drilled for coiled springs that press together friction plates at both sides of the web. In this design, the driving and driven frictional members are in rigid connection with the crankshaft and damper respectively, and the riveting action observed with the multiple disk clutch is therefore eliminated. Moreover, the frictional members are self-adjusting for wear, and there is no need for ever taking up on the springs.

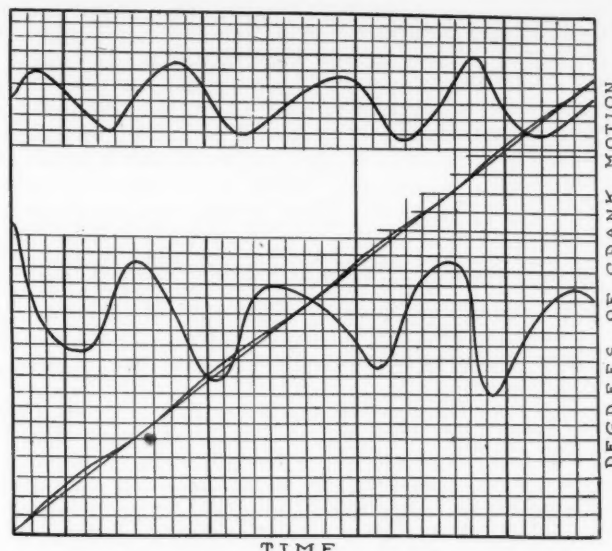
FLYWHEELS TOO LIGHT

One of the things learned in this experimentation is that the flywheel of the vibration damper can be made too light, but it cannot be made too heavy. If the design of the damper is such that it is effective, the damper gets moderately warm, but if it is ineffective, it gets abnormally hot. It was found that the unit pressure on the frictional surface must not be too great, as then the asbestos fabric will lose its frictional quality and wear rapidly. A pressure of 80 lb. per sq. in. seems to be about the limit.

A special apparatus was built in order to prove beyond doubt that the trouble was due to torsional vibration of the crankshaft. This comprised a tuning fork, which was set into vibration and caused to describe a record of its vibrations upon a disk secured to the forward end of the crankshaft. The record of a tuning fork vibration is a sine curve, and as the tuning fork was moved at a uniform rate from the axis of the crankshaft outward, this sine curve record was traced on a spiral basis. If the crankshaft had been rotating at a uniform rate, the period of all sine curves would be constant, each denoting one complete vibration of the tuning fork. As a matter of fact, these periods were not alike, two periods of short duration being always followed by two periods of long duration. These records were transferred to a co-ordinate diagram in which abscissas represent time and ordinates displacement of the crankshaft. If the rotary motion of the crankshaft were uniform this would give a straight inclined line. In reality a curve was obtained which crossed the straight inclined line at intervals. From this curve, which really represented the motion or displacement of the shaft end, were constructed curves representing the speed and acceleration at the end of the shaft.

Prof. Lewis showed by a simple apparatus what is meant by torsional vibration. This consisted of a weight suspended by a length of wire, one end of which was held in the hand. By twisting his hand he could give a rocking motion to the weight, and by timing the impulses given to the wire so as to correspond to the natural period of vibration of the weight and wire, the swinging motion could be brought up to a high amplitude. On the other hand, if the impulses were timed at a much higher rate, they had no influence upon the motion of the weight.

It was shown that the torsional vibration characteristics of a shaft depend upon the length and rigidity of the shaft.



Crankshaft motion, velocity and acceleration curves

In the submarines there would be three different periods of torsional vibration, one corresponding to the coupling together of the engine crankshaft, the generator shaft and the propeller shaft; another to the coupling together of the engine crankshaft and generator shaft, and the third to the engine crankshaft alone. The crankshaft may vibrate torsionally in different ways. For instance, one end of the crankshaft may speed ahead and the other end lag behind, with a node at the middle of the length. This is the simplest form of vibration, and will occur at the lowest speed. In the second form, both ends of the shaft may speed ahead or lag behind, with two nodes along the length of the shaft. In the third form, one end of the shaft will speed ahead, and the other lag behind, with three nodes along the length of the shaft. If vibration in the first manner occurs at a certain speed, that in the second manner will occur at twice this speed, that in the third manner at three times this speed and so on. These speeds are known as the primary, secondary, tertiary, etc., critical speeds. In practice, only the first and second critical speeds need be considered, as the higher critical speeds generally lie outside the operating range of the engine.

With geometrically similar shafts, the periods of torsional vibration vary as the linear dimensions of the shaft.

VIBRATION PERIODS VARY

Mr. Akimoff, the dynamic-balancing specialist of Philadelphia, said that the model exhibited by Prof. Lewis was not similar to a torsionally vibrating shaft, as the model possessed only a single period of vibration. A plain cylindrical shaft had a series of periods, bearing to each other the ratios 1; 2; 3; 4; etc., but when flywheels were put on the shaft, the manner of vibration changed entirely. He discounted the possibility of calculating the period of torsional vibration, as the problem was too complicated. It was not so much to determine what would be the periods of vibration, as to decide what to do with a shaft already built that vibrated inordinately. What was required was an indicating instrument showing the amplitude of vibration. It had been found that the damper ran ahead of the crankshaft. A damper was objectionable, as it meant friction and heat, and it was certainly a very much better plan to break up the periods.

Mr. Roos of the Locomobile Co., said that they had had considerable experience with torsional vibration. They had designed several types of dampers, and at present were using a type similar to that finally adopted for the submarine engine. Torsional vibrations could be reduced by lightening the reciprocating parts, as by using aluminum pistons, and also by increasing the diameter of the crankshaft. Both of these expedients, he said, would increase the critical speed of the crankshaft. They had built engines with both seven bearing and four bearing crankshafts, and found that there was more

torsional vibration in the four bearing shaft. They had also built crankshafts both with and without balance weights, and the crankshaft without balance weights vibrated the least. In making use of the balance weights, they had started with very heavy weights, balancing not only all of the rotating parts, but some of the reciprocating parts as well, and they had gradually cut down this weight, but no advantage over a shaft with outbalance weight was found, so far as the torsional vibration was concerned. When a four bearing crankshaft was substituted for a seven bearing one, the critical speeds became blurred, and moved closed together. Some of the crankshafts had been made with dummy journals, that is, some of the journals were not supported by bearings, and this farther reduced the critical speed. It was found impossible to secure an adjustment of the damper to wipe out all periods.

Mr. Crane said there was a general impression that four cylinder crankshafts were not subject to torsional vibration, but he had had experience with a four cylinder, 4x5 in. engine, having a 1 7/8 in. crankshaft, in which there was very severe torsional vibration between 1200 and 1800 r.p.m. This vibration caused the timing gears to make so much noise that the engine became an impossibility. One of the reasons we are having trouble from torsional vibration is that the mean effective pressure of engines is gradually creeping up. Where formerly 90 lb. per sq. in. was considered a good value, we now obtain 100 lb. at the speed that the lowest critical speed is likely to occur.

Fred Duesenberg said that their experience had been mainly with 4- and 8-cylinder engines. They used aluminum pistons and extra heavy shafts, and had had very little trouble from periodic vibrations.

Mr. Wolf pointed out that in the submarine engine there had been a good deal of trouble with the camshaft drive, as a result of torsional vibration of the crankshaft, and suggested that such trouble could be eliminated by driving the camshaft from the flywheel end. In this connection, Mr. Horine remarked that the reason why camshafts were not driven from the flywheel end was apparent to anyone who had had any experience in repair shops. Prof. Lewis said that the proper part of the crankshaft at which to fix the camshaft driving gear in order to insure the smoothest possible drive, would be that at which the node is located, which would generally be the middle of the length of the shaft, but this would be an inconvenient place for the drive.

One member related some experience he had with an engine turned out by one of the pioneer makers several years ago, in which, in addition to the regular flywheel at the rear of the engine, there was a front flywheel. One after another of these engines would break its crankshaft.

Mr. Roos reverted again to the subject of engine balance weights, and said that they were a detriment from the standpoint of torsional vibration. Rolls-Royce in England had come to the same conclusion, and he had had a talk with M. Barbarou, of the Dietrich firm, who had obtained the same results.

One of the speakers suggested that it might be possible to use springs instead of a frictional device to absorb the energy usually causing the torsional vibration, and arrange matters so that these springs gave out the energy again when it would tend to stop rather than to promote the vibration. This, however, was considered impracticable, as such a device would be likely to have a period of vibration of its own.

Solving the Problem of the Railway Motor Car

(Continued from page 24)

tration of the dual car depicts a scheme to avoid turning at the end of the run as well as to afford greater carrying capacity. Here two 25-passenger motor cars are coupled back to back and when running in either direction one car is a trailer, the engine of the other car supplying the power. This dual set has been making 150 miles a day since March last. Note that four wheel trucks are substituted, and the use of sand boxes is provided for. The photo of what seems to be a bus turning around will be seen to be (on closer inspection) a bus with flanged wheels. This is an electric railway adaptation and shows how the car is turned at the end of the run, i. e., by running off the end of the track and turning as an automobile, the return to the rails being guided by castings made in a shape similar to re-railing frogs. The possibilities of a motor car for special service and as an "owl car" are quite evident.

Some novel features are introduced in the author's design of folding turntable for use on through tracks when there is no other suitable location for a turntable and no other means of reversing available.

As will be noted from the drawings, the construction necessitates lowering the face of two or three ties at the center and clearing away the ballast to form a pit 4 or 5 in. deep for the sweep of the center plate, which is mounted on the same bearings as detailed for the fixed turntable. The center, or cross plate is of steel and has near its ends the castings for the hinge bolts of the chairs which carry the "track" and which fold down out of the way (and are locked) when not in use. The folded position is shown by the dash lines to be well within the requirements of "nothing above rail height." It will be noted also that the load is so placed that overturning of the chair is impossible.

Instead of running on the tread, the wheels run on the flanges while on the turntable. Twelve foot lengths of angles are secured to the chairs and upon the short legs of

these the flanges run. These angles are gaged to allow a running clearance only. The length has been found to be ample for cars of 120 in. wheelbase. Angles of this weight are stiff enough to clear the rail when loaded with a car of less than 4,000 lb. weight.

Because of their length and of working fits, the angles are subject to sidewise deflection at their ends, and it is to overcome this, as well as to provide the customary lock, that the guide bar—GB in the perspective drawing—was designed. Its thickness is equal to that of the angles' clearance above the rails, so it provides a firm support under the angles at the time the car rolls on the table. Wedge-shaped pieces R R are welded to the bar and form a smooth incline between the rails, both going on and coming off. The locking features include the bolt P set in a tie plate near the pivoted end of the bar, pins P and P' which prevent inward deflection of the angles, and pins P' outside the rail-heads.

Operation of the turntable begins with a stop of the car some ten feet away. The angles are unlocked and raised, the guide bar (which has been locked alongside the rail, outside) is swung around to position, and the car may then be run upon the turntable, centering it by feeling the tip, or against a stop. The bar must be moved clear of the angles for turning the car, after which it is replaced, the car run off, and all parts are locked out of the way.

The Index

YOU will, of course, miss the semi-annual index in this number. If you want one, drop a letter or card to the Editorial Department, AUTOMOTIVE INDUSTRIES, 239 West 39th street, New York City, and one will be forwarded. The reason for the omission is explained on the editorial page.

A New Market for American Trucks

The government of Ecuador has constructed seven new post roads, which render that country a market for the American exporter of motor trucks. Consul-General of Ecuador at New Orleans describes the type of truck best adapted to his country's needs, and points out sales possibilities

OPENING of a new steamship line, the first direct communication, between New Orleans and Guayaquil and Esmeraldas, Ecuador, and the construction of a trunk line of railroad from Quito, tapping the interior of western Brazil, and connecting with the line now running between Quito—the capital—and Guayaquil, the principal seaport; together with the construction by the government of seven post-roads, makes Ecuador a new field for the American truck exporter, according to Dr. Carlos A. Bermeo, consul-general of the South American republic at New Orleans, in this interview especially for AUTOMOTIVE INDUSTRIES.

"Ecuador, and the western part of Brazil, which is naturally tributary to the ports of Ecuador, is a tremendously rich country," said Dr. Bermeo, "but it is almost entirely undeveloped because of the lack of transportation. The government is building one trunk line of railroad, out of its own funds, paying cash for everything as it goes, and issuing no bonds, but this does not provide for the enormous agricultural sections, the vanilla and cacao plantations, the rosewood, ebony, mahogany and dye-wood forests, the cattle ranches or the mines, which are being served inadequately today by mule trains and by *cargadores*, these being Indians who carry packs of two or three hundred pounds on their backs.

"Recognizing this condition, the government is building post-roads, connecting with stations on this railroad, and running for hundreds of miles through the agricultural, timber-producing and mining sections. Unless American exporters and manufacturers, however, introduce, demonstrate and sell motor trucks, these roads will be used only by mule pack-trains and wagon trains. All told there are something more than one thousand miles of these roads, the railroad itself being about 250 miles in length. I am informed by the department of public works of my country that there is need for a fleet of about 200 motor trucks for use on these roads alone, and I believe a good salesman sent into my country immediately, would be able to obtain the aid of the department of public works in placing these trucks.

"It is possible, furthermore, that the government itself, would buy several trucks for use in the army, for transporting mails, and similar purposes. This, however, is not official, and I believe the usefulness of the trucks, of which little is known in Ecuador, would have to be demonstrated under private ownership and by the salesmen of the American companies, before the government would put any large sum of money into it.

"The roads of Ecuador, such as now exist around the cities, like Quito, Esmeraldas and Guayaquil, are built of stone, and all the post-roads are to be built of the same material, making them easily the best roads in South America, and among the best in the world. All are being constructed by army engineers with material and labor supplied by the plantation owners, mine-operators and town authorities along their various routes. All must be uniform and of the same material and same type of construction throughout, while all are being inspected by government engineers as rapidly as they are completed.

"These factors guarantee the American truck salesman an excellent field for demonstration and use, and first class roads for the operation of the trucks.

"Both small and large trucks, ranging from one to ten tons, are needed, and I would suggest that firms making the various sizes combine and send one or two men with a truck of each capacity for demonstration. It is useless to send men who do not speak Spanish fluently, for two reasons: the first, that it is impossible properly to demonstrate and explain the use of these trucks through an interpreter, no matter how familiar he may be with both languages, and, second, that the people of Ecuador, including the government agents, were accustomed for years before the war to dealing with British, French and German agents who spoke Spanish, and who often spent months in the country learning the language before they attempted to make a sale.

"As a result, my countrymen believe that the foreigner who does not care enough about Ecuadorean business to learn the language of the people to whom he is trying to sell large consignments of costly goods must be handling goods of small value. I believe this idea prevails throughout Latin-America, and that it is, to a great extent, the cause of the failure of the American to excel the Britisher, the Frenchman or the German as a salesman in those countries.

"The motor truck salesman need have no fear of lack of fuel for his vehicles in Ecuador. Gasoline is as cheap in Guayaquil and Esmeraldas as it is in the United States, and very little higher in Quito, though physically very much higher, inasmuch as Quito is 11,000 feet above sea level. Oil has been found in the interior of Ecuador, and along the north coast, near Esmeraldas, and a refinery is being established at that port, all under government control and by government concession, so that gasoline and kerosene soon will be much cheaper in Ecuador than they are here.

"I believe that the ideal truck, however, for my country, and, possibly, for much of South America, would be one driven by an engine operating on crude oil, if such is obtainable. The American company sending truck demonstrators into Ecuador also should understand that the introduction of their product is not a matter of days or weeks, but is a steady drive of months, probably six months, before the best salesman and the best demonstrator in the world will begin to show results.

"The men of Ecuador are not skilled in the handling of internal combustion engines; they must be taught this.

"The shippers are not acquainted with the value of ship-by-truck methods as employed in the United States; they must be persuaded of their value.

"Routes must be outlined, schedules drawn and native drivers taught to maintain them.

"The government officials know the worth of motor trucks as demonstrated in the war, and as used in peace times in the United States, and will do all in their power to advance the movement in Ecuador.

"With the new steamship line connecting both the important ports of Ecuador with New Orleans, shipment of trucks is comparatively simple. The first ship, *Nika*, a wooden vessel of 3,500 tons, left New Orleans about Dec. 1, and will call at Guayaquil and Esmeraldas, besides Colon and Panama City, in Panama, and two ports in Colombia."

System and Organization as They Fit Commercial Activities

This is another of the interesting papers presented at the Boston meeting of the American Gear Manufacturers' Association. Mr. Nicholson shows how the commercial department may be made profitable, and points out the necessity for close co-operation between the commercial and production departments.

AT the semi-annual meeting of the American Gear Manufacturers' Association in Boston, S. L. Nicholson, assistant vice-president of the Westinghouse Electric & Manufacturing Co., delivered an address outlining the proper organization of the commercial department of a manufacturing business, with particular reference to the gear business. Mr. Nicholson said that usually the commercial organization was considered the last hair on the tail of a dog; that it was regarded as a necessary evil. However, if properly organized, the commercial department could be made more profitable than any other. We had heard much talk for some time about the high cost of living, and had often been told that the way to combat it was to increase production. But how is this increase in production to be brought about?

Frequently a business is established by an intelligent workman with some initiative in his make-up. When the enterprise is launched, some business may be obtained from friends and, of course, it does not require a great amount to keep a small concern going. If the business continues to grow, however, it often does so by accretion, rather than by a determined push. It is not so easy to get into the gear business today, as all kinds of necessary equipment are very much more expensive, and those already in the business have a big advantage over the new-comers. With up-to-date commercial methods, however, a new concern may get ahead of an old one that merely drifts.

In any business, if it continues to grow, there comes a time when a regular commercial department must be organized. "How many of you," Mr. Nicholson asked the audience, "really study the supply and demand?" From the wording of the proposed standard quotation form, which started off with the words, "In response to your inquiry of," it would seem that the gear manufacturers intended to take care only of business that was offered to them. This, however, would not be sufficient. It would be necessary to go out after business. If the flow of orders should begin to slow up, the first thing for a concern to do would be to look over the list of old customers who had not been buying for some time, and to send out salesmen to try to rejuvenate them. The manufacturer should know particularly the possibilities of the territory around him. His salesmen should see all in that territory who ought to be doing business with him and are not.

Much importance was also attached by the speaker to the selection of the proper material for salesmen and to their schooling. There had been no end of efficiency methods introduced in the shops, he said, but at the commercial end of the business, efficiency was usually forgotten. The practice was to hire a salesman, to give him a catalogue and tell him to "go to it." If he made good, he would be regarded as a wizard, if not, he would be declared a failure.

It was also shown by the speaker that an intelligently con-

ducted campaign of education would make it possible to materially increase the market for gears. He urged the gear manufacturers to send out their commercial representatives and show prospective buyers that it would be to their advantage to use gears instead of belts. As an instance of what could be accomplished in this way, the speaker mentioned his experience in the electrical field, where a determined campaign had been conducted to induce plant owners to substitute electric motor drive for belt drive from a prime mover. The shop owner was told that by doing away with his line shafting and driving machine tools by motor, he could save about one-half of his power cost, as about 50 per cent of the power is lost in the line shafting. Although the proportional saving in power was relatively great, when it was figured what this amounted to in cheapening the product, it was found to be only $\frac{3}{4}$ per cent, and such a slight saving, of course, did not appeal very strongly to the prospect. On the other hand, if an increase in output of say 15 per cent could be shown, he would be interested. The manufacturers of electric motors then seized upon the slipping of belts as a factor that lent itself as an argument to induce shop owners to install electric drive. If the belt is properly tensioned, there may be very little slip, and the tool may be operated at the proper speed, but this is seldom the case, and the speed of the tool and its output decrease in direct proportion as the slipping increases.

A GROWING BUSINESS

The gear business, Mr. Nicholson said, was a real business, and could be made to grow like a green bay tree. First it was necessary to find out where gears could be used to advantage, and then what was the best type of gear to use in the particular case. What the gear manufacturer should be selling was quality and service, not merely gears. Anybody could get gears cast and get the necessary machinery for cutting them, but it was not everybody who could furnish the much desired engineering and commercial service.

Mr. Nicholson asked how many were present who could tell what proportion of their proposals actually resulted in orders. In the discussion of the proposal form, some one had remarked that if a contract should be cancelled before any actual work had been done under it, no demand for compensation should be made on the purchaser. He evidently was under the impression that up to that point his company had not been to any expense. This was far from being correct, as in the case of the writer's own firm it cost \$8.50 for every quotation made. They had not realized that the expense of making quotations was so high until they actually figured it out.

Mention was made of one firm which was satisfied if it turned 10 per cent of the business bid for into actual orders. The ratio between the number of proposals and business secured should always be considered. All proposals made should

be divided into three classes, namely orders secured, orders abandoned, and orders lost. In one particular case it was found that the number of proposals abandoned through neglect to follow them up properly was three times as large as the number of orders secured. The speaker said that 90 per cent of business lost was not lost on account of price, if the concern was right. If you believe in your own ability—and almost every concern in business does—you can convince the customer that you can give as much for a dollar as your competitor, and this accomplished, it is only a matter of salesmanship.

All quotations that are made over the telephone or verbally, should be at once confirmed in writing. They should also be given a number. If you make a quotation verbally, have a clerk confirm it, and place a carbon copy of the written quotation in a folder. The next move is to follow this proposal up. If a reply is not received within a reasonable time, depending upon the size of the order, from a few days in the case of a small order, to a week or more in the case of a larger one, either send a salesman to call on the customer, or follow your proposal by mail. The duplicate of the proposal remains in the sheet folder until the business is secured, lost or abandoned. It is not removed from the folder until it either has an order pinned to it, or a report showing that the business was either lost or abandoned. A monthly summary can readily be made, which will show whether the number of quotations is increasing or decreasing. It is also possible from these records to find out the average time elapsing between the date of quotation and the receipt of the order, and this enables you to foresee a slump either as regards the business in general, or as regards work for any particular department of your plant.

Salesmen should be required to make daily reports, in such a way as to enable the manufacturer at any minute to analyze the status of any negotiation. If there is a prospect that any particular machine in the shop will be idle in the near future, owing to a dearth of the class of work that it handles, salesmen can be sent out to work on quotations of that particular kind of business and in this way it is possible to smooth out the valleys in the production curve.

The salesmen's daily reports should be copied in the office, slips being made out in duplicate, one copy for the salesman's book and the other for the book in the office. The speaker cautioned his audience not to evolve too elaborate forms for salesmen to fill in, as they simply would not do that. Salesmen are not systematic by nature. When the salesman's report comes in, it goes to the same stenographer who made out the quotation in the first place, and it is entered in the office book. The only two things that the salesman has to make out is the order and the daily report. The amount of clerical work connected with the system as described is not very great, and two clerks can take care of the records of 150 salesmen.

FOLLOWING UP INQUIRIES

As regards the method of following up inquiries, the speaker gave the following example: Suppose you get an inquiry for some goods from South Bend, Ind. You may have a salesman on the road in that vicinity. The same night the proposal goes out to the customer, and a duplicate of it is sent to your salesman with instructions to call on the customer as soon as possible. The salesman will explain to the customer that he heard from the factory that they had an inquiry from him for certain goods, and that he called to see what particular purpose the goods were intended for and how he could be of service to the customer in connection with the order. Such a procedure usually impressed the inquirer with the fact that the firm he dealt with was a live one, and it generally was a wonderful help in securing business.

There were two general types of salesmen. To deal with entirely new customers the writer's firm employed so-called development salesmen, who were men with an engineering training who could give advice to the customer and gain his confidence. This class of salesman, however, was comparatively expensive, as they usually asked to confer with the customer's chief engineer, and would spend considerable time in going over the details of the proposed installation. The development salesman, however, was a very great asset to a firm in first getting into business relations with customers. Later

on, when permanent business relations had been formed, it was usual to employ so-called service salesmen. It had been found that a service salesman can handle from three to four times as many customers as a development salesman. When it was decided to make the change the development salesman would take the service salesman around with him and introduce him to his customers. It was found that as the relations with a particular customer grew older the selling cost constantly became less. It might start at 15 per cent and when it came down to 5 per cent it was felt that the development salesman was no longer needed for that particular customer. He would then be given a new list of customers to work up.

THE GEAR BUSINESS

There are two classes of business catered to by the gear makers, Mr. Nicholson said, known respectively as industrial gearing and automotive gearing. The former is an entirely different proposition from the latter, which is quite limited so far as the possible number of accounts are concerned. It has been found that the business of industrial gearing is very largely a localized business, very few orders coming from points more than 250 miles from the plant. The effort of the gear makers should be devoted mainly to developing business within their local zone; in looking about him, he might see many green pastures beyond the fence that enclosed him, and he might be strongly inclined to stick his head through the fence and nibble at the grass beyond, but development of local business was more profitable. He knows the local field better, runs less risk of loss through bad accounts and will remain on a better footing with competitors. The systematization of the business outlined not only brings more business, but reduces the cost, because it enables the manufacturer to know exactly where to go to fill up certain parts of his shop.

As regards the salesmen, it is not proper to judge their work by the sales costs. A salesman naturally wants to go after the customer who is easiest to sell, so as to make the sales costs as low as possible. However, the work that really counts is to get the difficult customer. One method of furnishing an incentive to the salesman that had been tried with success in the electrical business was to make an estimate of the possible annual business in a given town on the basis of the population and then asking the salesman to develop that business. This had worked out very well.

MMAGNETOS, by A. P. Young, A. M. I. E. E. Published by Iliffe & Sons, Ltd., London. Price, 4/6d.

During the past five years there has been a rapid development of the magneto industry in Great Britain, which country, previous to the war used German magnetos almost exclusively. Owing to the fact that in modern high tension magnetos a good many materials are used for which there is no demand in other lines, the development of this industry involved unusual difficulties. Intense study of the various problems was necessary and was, of course, strongly encouraged by the Government. One of the men who devoted themselves to this study of magneto problems was A. P. Young, who read a number of papers on the subject before the Institution of Automobile Engineers and the Aeronautical Society of Great Britain. He also lectured during the war to officers and men of the Royal Air Force in France, and, as an outcome of this series of lectures, he has now brought out a book on Magnetos. The author disclaims having had the intention of producing a technical treatise, but nevertheless his book contains a lot of information which usually escapes the man who is familiar with magnetos from the operating standpoint only. The general problems of magneto ignition are handled under such headings as The Magneto, Evolution of Electric Systems of Ignition, The Working of a Magneto, The Process of Ignition, Magnetizing and Timing a Magneto and Testing.

Personality and Service as Publicity Mediums

Mr. Grogan looks at the problem of automobile publicity from a new angle. He believes in making yourself as well as your product have a news value. His views are unusual and include constructive suggestions along with criticism of present methods.

By S. S. Grogan

TWO dealers in Washington who sell established make cars seek neither publicity for themselves nor for the cars they represent. The cars they handle in a measure owe their success to the efforts of the firms that represent them.

Rarely is the name of the car they represent mentioned in a story, but so closely allied have these men become with the lines which they represent that to mention one immediately brings to mind the other. To keep them out of public print, or from discussion, where a crowd is gathered is difficult. They have built for themselves a news value.

How have they done it? They have done it by interesting themselves in every civic movement. Both are busy men, but they only prove the adage that if you want something done, and done in a hurry, get a busy man to do it.

They are everyday individuals. Both are hardheaded business men who have made their way to the topmost positions in the firms they represent. They are, naturally, not adverse to publicity of the right kind; by their efforts to promote their own business and tie it up with the success of the community have grasped the big idea—mix and by your personality and service draw people to you.

The automobile dealer in his community, next to the real estate agent, sells the one highest-priced article. He has this over his real estate brother, who makes one sale of a home or business property to a man and this ordinarily does for a number of years, whereas the owner of an automobile averages a new machine at least once in three years. This means that the real estate operator must constantly develop new fields while the motor car representative can cultivate his present field at the same time he is developing new prospects.

Many automobile purchases are the result of savings and sacrifices. It takes a great deal of confidence in a man to turn over to him, for something that becomes a liability in a short while, an asset that is the result of hard effort. That confidence is not gained in a day—it requires efforts and the greatest method of proving worth of this confidence is to subserve self for the general good.

Newspaper publicity can make or break a man. Some one has said, "Let me write the headlines of a newspaper and I will control the opinion of the world."

Automobile publicity, as it comes across the desk of the automobile editor, is at times an effort to get for nothing what others pay for at the agate line rate. Fortunately the type of publicity department that states we are sending so many lines of advertising and expect use of the reading notice enclosed are no more. The

paper is thereby relieved of the unpleasant task of sending regrets at inability to comply with the request.

With 6,000,000 motor cars of about 300 different makes in service, there must be some good in all, else people would not invest their money in them. There is so much that can be written about the motor car in general that it seems hardly fair for some by lengthy stories to try and monopolize the available space. There are space writers so adept that it is hard to "cut" their stories. Others ramble on and try and see how often they can mention the name of their car in a paragraph. Every city has local automobile news that is interesting to the car owner and space must be found for it no matter how much the individual in charge of the department would like to print prepared articles.

"Canned" stories are all, no doubt, interesting to the man who pounds them out—but how about the fellow many miles away who receives them? He is not surrounded by the local atmosphere in which they are written and to him they represent only so many typed pages unless they have real news value. He cares nothing about what fine fellows the president or sales manager are or how many companies they have started on the road to success. These men have only a local news value if they can by their varied experience offer something better in the way of an automobile. Stories that come with the parenthesis "insert dealer's name here" are unfortunate in this respect. They rarely quote the dealer as he is in the habit of talking.

There is one infallible manner of arousing interest in the automobile buying public—the class all dealers want to meet. Talk about something that touches their pocketbook. Mingle in any gathering of owners and, when the conversation gets around to motor cars, as it will, this is an important topic of conversation. Service is another point that brings both dealer and car into the limelight.

Factories anxious to progress give a great deal of attention to what is termed field service. Men are sent to various distributors and agencies to explain and install sales and service ideas which have worked out successfully in other localities. It is done with the idea of greater business and more pleasant relations between customer, dealer and factory.

In one particular the most effective sales plan has been ignored—the value of the dealer as a news medium. Every day the automobile department of a newspaper is solicited by some automobile feature service company who claim to have something that will interest the automobile reading

public. Certainly if the feature press syndicates can dig up automobile stories which the papers will buy—and they sell to some big papers—the automobile manufacturer who has most at stake in the way of popularity of his product and the consequent amount of business that the available market will produce must have something of interest.

If this news—and it is news—insofar as it may offer something of interest to the automobile owner, can be dug up by those not directly engaged in the manufacture and sale of cars, there must be a great deal that those on the ground floor have overlooked.

The factory that starts such an educational campaign cannot hope to have the man on this work produce direct results. He can only sow the seed. The dealer must cultivate it and the harvest will be beneficial to both dealer and manufacturer. The idea of it all must be big and broad—the automobile as a part of our everyday life and its niche in the affairs of the community.

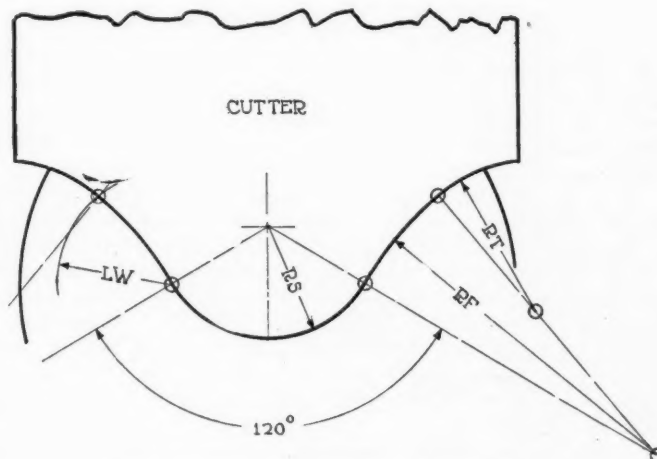
The dealer must be taught that the question of focusing public attention on himself and the line he sells depends no longer upon the idea of handing to the newspaperman a prepared factory article, but upon his own ability to make news of himself or his car.

With the white paper situation as it exists today, automobile reading matter must have a greater local color than ever before. If once the papers cease to devote special sections to the motor car and consider it in the same light as they do other lines of business, it means farewell to anything but the liveliest of motor news.

No doubt for sometime to come there would be no effects felt from this lack of talk about motor cars in public print, but when factories get back to normal production and the supply equals the demand publicity will be a great sales aid in convincing the individual that an automobile should be numbered among the necessities of his household.

The Standardization of Roller Chains

THE Association of British Chain Manufacturers is standardizing roller chains, and the new standard up to $\frac{3}{4}$ -inch pitch, has already been announced. To ensure complete interchangeability, tooth forms have also been standardized. The Association form, while not identical with any existing form, incorporates the essential features of all. The general construction is shown by the accompanying diagram. It consists of a roller seat, working faces and top curve, all of which are arcs of circles. The angle of 120 degrees subtending the roller seat, has its origin at the center of the diameter of the roller seat. The working faces are comparatively flat curves tangential to the roller seat and the top curves are tangential to the working faces and of such a radius as to permit a suitable height of tooth. The dimensions of tooth forms for chains up to $\frac{3}{4}$ -inch pitch are given in the following table:



The general construction of roller chains

Roller Dia.	Cutter No.	No. of Teeth to Cut	Length of Working Face L. W.	Radius of Roller Seat R. S.	Radius of Working Face R. F.	Radius at Top of Tooth R. T.
.250	1	9-12		0.126	0.45	0.45
	2	13-19	0.12	"	1.125	0.18
	3	20 and over	0.154 (min.)	"	3.825 (min.)	0.052 (max.)
.305	1	9-12		0.154	0.6	0.5
	2	13-19	0.16	"	1.5	0.24
	3	20 and over	0.205 (min.)	"	5.1 (min.)	0.07 (max.)
.335	1	9-12		0.169	0.6	0.6
	2	13-19	0.16	"	1.5	0.24
	3	20 and over	0.205 (min.)	"	5.1 (min.)	0.07 (max.)
.4	1	9-12		0.202	0.75	0.75
	2	13-19	0.20	"	1.875	0.3
	3	20 and over	0.256 (min.)	"	6.375 (min.)	0.087 (max.)
.475	1	9-12		0.240	0.9	0.9
	2	13-19	0.24	"	2.25	0.36
	3	20 and over	0.307 (min.)	"	7.65 (min.)	0.105 (max.)

A DISPATCH from Stockholm states that the Karlsborg Radio Station, the largest in Sweden, which has lately begun service with many countries, including regular communication with England and Germany, will establish a regular service with America upon completion of a test with an American station outside New York.

ACCORDING to a Swedish paper, the Deutsche Luftfahrt Company A.G., which has amalgamated with the Hamburg-Amerika Line, has entered into negotiations with a Swedish aviation company, with a view to establishing a line of Zeppelins between Germany and Sweden. The new line is to run from Friedrichshafen to Stockholm.

The Benefits of Details in Plant Management

In continuing his remarks upon the Bullard Plan of cutting down turnover, Mr. Tipper takes up the small points which are made to work for the benefit of contentment and good will, instead of accumulating against the company through neglect, as is so often the case

By Harry Tipper

A FEW weeks ago we spoke in these columns about the results of the organization work of the Bullard Machine Tool Company, and we intimated that we might find it necessary to describe the details of these plans in another article.

In going into these details, it is obvious that the general method of payment and the general arrangement of the plans in the Bullard factory are not materially different from those which are obtained in many other factories. It is the great care in the little things which makes the difference in the actual operation of these plans in this particular arrangement. Long experience of observation in the industrial affairs and industrial organization has indicated very thoroughly that the spirit of an organization is determined by the little things of constant application.

It is the small continuous neglect of the individual in the rules between the company and its workers, the lack of trifling explanation, the slight indifference to the personal pride of the employe and the little injustices which creep in here and there because of this lack of consideration, which spoils many a well laid plan and which have more to do with the results from a production standpoint than the general elements of any plan.

In the details in the plan which are indicated herewith, the value must be looked for, not so much in the plan itself, although some of the detailed methods of carrying out this plan are indicated in the plan itself, but rather in the care with which the plan has been operated, the patience with which the plan has been explained, and the consideration which is involved in the method adopted to deal with any changes.

It was with some interest I observed Stanley Bullard punch the time clock when we went out to lunch and came back again. Obviously, we were not keeping to any set time for lunch, for the factory had been swinging along for quite a while when we returned from our noon-day recess, but Mr. Bullard was recording his own time as he expected the others to record theirs, and it interested me not so much from that fact, but as an exhibition of the care of which the organization and example of detail are worked out in the plan. The notice which went into the envelope along with the explanation of the premium or bonus plan of payment is another example of this capacity to introduce a change with the right atmosphere. This notice is suffi-

ciently interesting to introduce it in full in this labor article.

A SQUARE DEAL

No one ever expects to get something for nothing—no real man wants to.

That's the starting point for us both.

You can do the work that is to be done—do it right and do it quickly.

We want it done that way and believe that such ability is worthy of high reward.

The Maxi-Pay Wage Plan AND

Production Bonus

provides the channel for equitable exchange—it is based on.....

THE SQUARE DEAL

In the last article we mentioned the classification of the workers, in the booklet covering the organization policies and payment plans of the Bullard Company, so that the man who is working for the Bullard organization knows how he is classified and how he will be classified and in what way he will be advanced in the service and in his pay. This classification is so clearly stated and so well defined that it is easy to see how the ambitious workman can understand his complete program of advancement in his operations in the Bullard factory. The classifications are quoted herewith because of their definite character.

THE BULLARD

MAXI-PAY WAGE PLAN

Advances Wages in recognition of ability.

Provides a Wage Rate limited only by ability and occupation.

Offers full opportunity for advancement, along definite lines to those showing ability.

The success of this plan depends on the individual effort of each man and the co-operation of all.

There is no room under this plan for any but efficient workmen.

CLASS AA.

Sub-foremen and leaders in charge of working gangs of mechanics.

Maximum rate per hour dependent on ability.

See Rate Card for Minimum Hourly Rate.

Foremen and Shop Executives will, as far as possible, be selected from Class AA.

Class A.

Skilled mechanics of demonstrated first class ability.
Maximum rate per hour dependent on ability.
See Rate Card for Minimum Hourly Rate.
Vacancies in Class AA will be filled from Class A.

CLASS B.

Mechanics of good average ability.
See Rate Card for Minimum Hourly Rate.
Class B men will be advanced to Class A when qualified as shown by efficient and intelligent service.

CLASS C.

Mechanics of limited experience, who, by efficiency, interest and service may merit advancement.
See Rate Card for Minimum Hourly Rate.
Class C men will be advanced to Class B when qualified as shown by efficient and intelligent service.

CLASS D.

Apprentices, both special and regular.
See Rate Card for Hourly Rates.
Class D men, upon completion of their apprenticeship, will be advanced to the class for which they qualify.

CLASS E.

Labor of all kinds, skilled or unskilled, which is not directly productive.
See Rate Card for Minimum Hourly Rate.
Maximum rate per hour dependent upon ability and occupation.

In the employment of unskilled labor, preference will be shown to those who can speak and write English and who show qualities which will later warrant advancement.

Unskilled men of this class showing adaptability, will be given full opportunity to become skilled by advancement to Class D.

The Bullard wage plan provides for a standard time and bonus of 1 per cent on each per cent of efficient above 75; provides for a trial time which is to be established on work where there is not sufficient experience to determine an equitable standard time; and it provides further a bonus of 10 per cent on the wages for attendance to all employees who have worked a full week and worked through the necessary regular hours.

In other words, this system not only provides an increase in the hourly wage according to the efficiency of the individual worker which is usual, but it also takes account of regular, prompt and continuous service quite apart from the increase in ability of the employee. In other words,

the executives of the organization have agreed that continuous and regular service is worth an additional recognition without respect to any change in the ability of the employee, due to that continuous service. There is justice in this plan because the employee who is always on time, always at his work faithfully in his endeavors to the company is a better man from an organization standpoint than the man who is irregular in his attendance and whose services cannot be depended upon continually.

A number of further exhibits could be made to indicate again, the care in little things which runs through the detailed plan of this organization. The envelope which is given to the individual worker when any notice is required is addressed:

To You as a Member of the Bullard Organization

The reason for medical supervision is stated very clearly, so that no man will see in it merely an exhibition of paternalism against which he is likely to revolt. Similarly the purpose of accident and health insurance. The life and total disability insurance and other items are similarly explained.

Perhaps one of the most interesting events of the year for the Bullard workers is the old fashioned Christmas party which is held every year in one of the large halls in Bridgeport. This party is for the children of the workers and the whole spirit of the party is indicated in the letter signed by the President which is sent to each member of the organization. At this Christmas festival every boy and girl belonging to the family of a Bullard worker receives a box of Christmas things, the same type of box for the President's children as for the children of the shipping clerk. At the Christmas party this year, there are to be 2,075 children.

150 under two years of age.
750 between two and six years,
575 between seven and eleven,
600 older than eleven.

The idea of making it a children's party is again indicative of the detailed human wisdom involved in the actions of this organization. When all is said and done, the spirit of consideration and tolerance which is behind this patient carrying out of detailed organization plans from the human side, is the great thing which is carried away from an observation of its workings.

Reclamation of High Speed Steel

DURING the war, many new firms started in business to manufacture munitions, and as a result of this and of the increased activity of firms already in existence, there soon arose a great scarcity of high speed steel, which is an alloy steel containing a high percentage of tungsten. Previously, the stubs of tools and cutters had usually been thrown away, but it was now realized that this was wanton waste, and steps were taken for reclaiming all high speed steel remnants, such as lathe and planer tools, broken and worn-out drills, cutters, reamers, forge trimmings, bar ends and miscellaneous pieces. A number of steel making firms engaged in this business, and since it proved highly successful during the war, they have continued it since.

Every piece of high speed steel scrap is tested by means of a soft, free-cutting alundum or corundum wheel, running dry, at the speed given by the maker, and located in a dark place. The tester takes a piece of steel of known quality and familiarizes himself with the character of the spark stream produced when it is held up to the corundum wheel. It is by the spark stream that he judges the scrap as regards acceptability.

After the scrap has been carefully sorted, it is melted in a

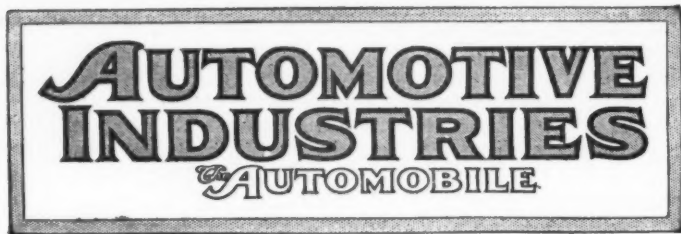
furnace and poured into ingots. These ingots are hammered into billets, and the latter are transferred to the rolling mill, where they are rolled out into the required sizes.

Only the higher grade high speed steels, containing 14 per cent of tungsten or over, are accepted for reclamation. Drills, reamers, or other tools having soft steel shanks are not acceptable, nor are oil tube drills, brazed tools, or scrap containing or carrying copper, brass or other non-ferrous metal, as these metals cannot economically be removed from the steel scrap and cause difficulty in the melting process.

The above information is taken from a booklet published by the Onondage Steel Co., which concern specializes in this business.

The Index

YOU will, of course, miss the semi-annual index in this number. If you want one, drop a letter or card to the Editorial Department, AUTOMOTIVE INDUSTRIES, 239 West 39th street, New York City, and one will be forwarded. The reason for the omission is explained on the editorial page.



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Some "welfare" plans have been conceived as a means of protection to the employer rather than as a means of affording to the worker a broader opportunity for development. Welfare work does not successfully cover a multitude of sins. When such a plan is installed primarily for the purpose of protection from labor trouble, its chance of success is not very good.

A spirit of real fairness, successfully communicated to the workmen, is the first fundamental of any service, works council, or industrial democracy scheme. One labor authority recently wrote, "The employer is realizing that the first commandment is: 'Be honest before you are showy—the workers will forgive anything but insincerity.'" Where this commandment is followed, service work and industrial democracy plans have every chance of being a real success; of being beneficial to both employer and employee.

Index for Current Volume Jan. 1

OWING to the difficulties of keeping the records of this publication in New York City and doing the printing in Chicago, it is impractical that we include in this issue the index. This, as all readers know, has been the custom for several years. We realize that the index is valuable to many of our readers and we do not wish to deprive any reader of this convenience.

The index for the last six months will be printed in separate form as quickly as the record department can complete its work. This index will be sent to all readers upon request. So we ask that any reader wishing to bind or otherwise include the index in his file of the last six months, write at once to the editorial department of AUTOMOTIVE INDUSTRIES asking for the index and the request will be complied with.

We regret any change in the establishment custom but this is one of the difficulties that could not be overcome in working out the problems arising from the recent printers' strike.

The Birth of an Idea

THE success or failure of any plan for the betterment of employees is usually determined when the idea of installing such a plan is born in the mind of the employer. When the idea is conceived in such a spirit of friendliness to the worker, with the initial intention of giving him a better opportunity for living a broad life, with the purpose of providing a means by which the spirit of industrial democracy already present may better function, the plan will in all probability operate successfully.

An inefficient staff placed in charge of the employee's service department may later interpret the plan clumsily or ineffectively, but a change in the personnel of that staff is always possible on short notice. The harm that can be done in this way is great, but it can be remedied. When a plan is conceived and installed in a spirit of honesty and fairness, nothing that comes afterwards can entirely offset the essential usefulness of the plan.

An Aviation Department

EVIDENCE that a sane plan for a Department of Aeronautics will eventually be evolved is shown in the bill introduced recently in Congress by Representative Morin. It is the first step toward a Department that will function like the other government bureaus as a collector and disseminator of aeronautic information, as a department promulgating and enforcing rules, as a body coordinating requests for appropriations and disbursing them according to law. In other words it will be an executive department and not an operating one. It will control aeronautics but will not operate planes or train pilots.

Though the Morin bill has a few objectionable features it is a great step forward and should be given earnest consideration by Congress. It should by all means be contrasted with the other bills already introduced and which will reveal the logic in the Morin bill by comparison.

Looking to the Future

HERE is a vision for the New Year from a man who knows automotive transport from the outside. The sternest of necessity has led him to certain conclusions as to the policy that must be adopted by the manufacturers. As such, we give it place on this page and hope that all who have viewed the future of the industry, especially the export trade, from the inside will take the lesson home.

We recommend this letter, which was written by Brig. Gen. C. B. Drake, U. S. A., Chief, Motor Transport Corps. Its subject is "Significant Motor Transport Lessons from the War."

1. In 1914, the passenger car was fighting its way into the utility class, the truck was a successful experiment to be seriously considered for short local traffic. Good roads agitation tended to put all automobile men under suspicion of being pork barrel politicians.

2. In 1919, the automobile stands in the eye of patriotic America as a tried and true mechanical hero of both war and peace, a stage above the idolized "soixante quinze" field gun of the French nation. Even France now recognizes the automobile as paired with its wonderful field piece for first honors in enabling the outnumbered French Army to withstand the Germans, while they waited and waited for Great Britain, for Italy and America.

3. Mobility, which is a synonym for superior motor transport, turned the tide and won the war. It is plain that it will be an equal factor in winning commercial fields.

4. The American automobile world must study foreign markets, overseas shipping, foreign transportation requirements and the trick of keeping the overseas vehicles running with parts, if possible, without parts, whenever necessary.

5. Service, in the automobile sense, will have a new domestic and foreign world opened to its vision and endeavor.

6. Motor transportation will follow the lessons of the war and operate in larger and larger groups. Perfection of designs and models will not longer monopo-

lize automotive thought. The Allied Armies have much to give the civilian world in motor transport organization, development of operating centers, elimination of "bottlenecks" which throttle terminal and road capacities, road values, training of operating and maintenance personnel, inspection, repair, supply and salvage methods, particularly in interchangeability of parts and accessories.

7. To the Motor and Accessory Manufacturers Association, the Motor Transport Corps, in return for the aid and counsel received in war, must look for understanding of the principle that adequate parts service is the Alpha and Omega of any motor transportation problem.

8. This means a new grasp by your Association and by manufacturers of the finished vehicles of spare parts experience data. The Army has learned that it must have about 200 parts on each vehicle in quantity, everywhere. Other parts are rarely required.

9. Apparent economies in this class of parts has proven lack of breadth of view. Every user and manufacturer must honestly study and understand quantities required for actual repair, for wider distribution than actual demand, and for shrinkage in factory, in transit, in sales, and in users' service stock. Ignoring human inability to make 110 pieces suffice for 100 new vehicles and 10 actual repair jobs has paid an enormous penalty in useful vehicle hours. All other vehicle hours are a financial burden on manufacturers as well as users.

Business of \$150,000,000 in 1923 Planned By British Combine

Details of the Amalgamation of Automotive Interests Discussed by British Expert. Plan Manufacture of Every Part of Car's Equipment

LONDON, Dec. 5—(Special Correspondence)—Capital is usually wanted under one of two circumstances, either to start a manufacturing business, to enable the promoter to buy with advantage and to finance the cost of manufacture; or, alternatively, to develop an existing business which seems to justify further capital on which a dividend can reasonably be expected independently.

If either of these tests be applied to the present exhausting thirst for capital in the British motor trade, the result is hardly satisfactory. Almost every day's papers contain a motor company promotion or extra capitalization prospectus.

The test just noted, if applied to these appeals, clearly reveals that the number of these flotations with real tangible assets, including the goodwill of an established and growing business is much smaller than the other sort. It is noticeable, too, that the calls for capital by companies or firms in the former group is for sums much more in keeping with the size and fair prospects of the business.

Regarding the other sort, it would seem that the promoters are ambitious and inexperienced in manufacture,—in some cases of any sort—and in other cases to an extent vastly smaller than the capital they are asking will require to earn a modest 5 per cent dividend. Besides, in some cases, manufacture is to all intents at present non-existent, and this without reference to the strike of the molders which is holding up output, or the hitherto plea of being in the transition stage from war-work to normal output.

It is possible that some of these multi-million pound appeals are based on the depreciated value of the pound, which represents at best about 40 per cent of the pre-war rate of the sovereign, but nevertheless the gross sum must remain at its face value for dividend to the investors.

What is known as the Harper Bean

Ltd. flotation is most in the public eye, partly because of the enormous sum asked for—\$30,000,000—and also on account of the hitherto comparative obscurity of the company—albeit highly respectable—whose name stands sponsor for this flotation.

FLOTATION IN PUBLIC EYE

The promoter is H. J. Whitcombe, an astute motor insurance expert, who in April last figured as one of promoters of the British Motor Trading Corp., capitalized at \$10,000,000. The new flotation is styled an "amalgamation," the term "combine" being objected to as savoring of the ramps commonly associated with trusts, etc. The prospectus states that the company will acquire the following interests:

99 per cent of the shares in A. Harper, Sons and Bean, Ltd., of Dudley, Tipton and Smethwick.

166,666 of the shares in Hadfield's, Ltd., of Hecla Works, Sheffield (subject to confirmation by their shareholders).

60 per cent (approximately) of the shares in The Vulcan Motor and Engineering Co., Ltd., of Crossens, Southport.

50 per cent of the ordinary shares in Swift of Coventry, Cheylesmore, Coventry.

50 per cent of the ordinary shares in British Motor Trading Corporation, Ltd., (fully paid).

50 per cent of the ordinary shares in Harvey Frost, Ltd.

100 per cent of the shares in Rushmores (1919), Ltd.

100 per cent of the shares in Jigs, Ltd.

100 per cent in the shares in Regent Carriage Co., Ltd.

100 per cent of the shares in Galloway Radiator Co., Ltd., and all the assets of Aeromotor Components Co.

100 per cent of the shares in Alex. Mosses Radiator Co., Ltd.

The balance of the cash proceeds of this issue, amounting to \$14,000,000, will

be applied, subject to the payment of the preliminary expenses, which are payable by the company, and are estimated not to exceed (exclusive of brokerage) \$250,000, to:

Extending the very important plant of A. Harper, Sons and Bean, Ltd., for producing drop forgings, castings, stampings, and kindred products.

To extending the plant for mass production of the Bean car upon a basis of 50,000 cars per annum.

To laying out a complete engine and transmission plant for producing 50,000 complete sets of Units for the Vulcan Motor and Engineering Co., Ltd., Swift of Coventry, Ltd., and other motor manufacturing companies with whom negotiations are in progress.

To providing the necessary raw material and stock of all kinds necessary to maintaining mass production.

To developing special plant for producing motor bodies cheaply, including the new aluminium alloy body of which Messrs. A. Harper, Sons and Bean, Ltd., hold the World's Patent Rights.

To developing the plant for manufacturing radiators under the patents of Alex. Mosses Radiator Co., Ltd., and Galloway Radiator Co., Ltd.

To developing the plant for producing electric lighting sets and self-starters for motor cars and other electrical equipment.

Generally to acquiring and developing interests for safeguarding and promoting all the various processes and businesses necessary to securing and maintaining mass production of complete motor vehicles of all types by the companies included in the combination.

It is estimated that greatly increased ratios of profits will be secured by each company when working under these methods than hitherto attained by them as separate undertakings. The amalgamated interests will be able to offer the

public their products at substantially lower prices than would be possible without such co-ordination of interests.

The company will thus be enabled successfully to combat foreign competition and secure an adequate share of overseas trade for Great Britain.

INCLUDES FOUR CHASSIS MAKERS

Four of the associated group are manufacturers of chassis. The British Motor Trading Corp. committed itself to about \$5,000,000 worth of Crossley cars, which so far does not seem to be particularly successful.

Harper & Bean are merely carrying on the output of the Perry light-car, pending a new model of their own. The output of the Perry was never sufficient to establish it permanently, and Harper & Bean on acquiring it, found it advisable to alter it for output purposes. The Harper & Bean business has hitherto been a family affair, and mostly concerned with stampings and forgings and pressings, etc., some of which were used by the motor trade. It remains to be seen whether, and to what extent, this part of their business will be affected by their becoming so closely identified with the group of chassis makers in this scheme. A profit of \$250,000 is anticipated for 1920 from this company's output of stampings, etc., for its associated motor and chassis output.

The Vulcan company is one of the oldest British chassis makers, and had grown from the smallest size before the war to the possession of an increasing factory of all new buildings, and an up-to-date plant, including a body-building plant. They introduced a post-war diagonal eight; production of which, however, remains in abeyance, and at the recent show at least one of their models was fitted with an engine of outside make. Though a large factory, the pre-war output is stated to have been only about 500 cars a year. It is proposed to increase it to 10,000 a year.

The Swift company also was one of the earliest in the cycle trade group to take up motor car building. The Du Cros family (of Dunlop tire fame) are heavily interested in this company. The pre-war output was probably under 300 cars, and for years the company failed to recognize the need and economy of concentrating on one model. At one period they listed as many as four types simultaneously.

BIG BODY COMPANY A MEMBER

Of the rest of the companies to be amalgamated, the Regent Carriage Co. is the most important in the motor trade. This company was one of the Du Cros group, and used to control the Napier bodies. Beyond a contract for some hundreds of Napier taxicab bodies several years since, its output has been almost exclusively of high grade and costly bodies. The works are in London, and none of the chassis works concerned is nearer than 100 miles distance.

The Hadfield connection is interesting

as being along the trend noted some time back, namely, the direct association of the big steel and armament companies with one or more motor companies. The most recent instance was the almost total acquisition by the Armstrong-Whitworth Co., of the Siddeley-Deasy Motor Co., but the precedent action of this sort was the absorption some years since by the Vickers' interests of the Wolseley Motor Co., which was followed after a long interval by the entry of the Beardmore interests into the motor trade.

Sir W. Beardmore, head of the latter group, is understood to be almost the sole proprietor of the Arrol-Johnston Motor Co., and his company has probably about \$10,000,000 invested or ready at call for investment in motor enterprise. It is not amiss to mention here that the Beardmore and Vickers interests separately have programs of motor output numerically as large as that of the Harper-Bean group, and in the case of the Beardmore interests, the capital is but a third of what the Harper-Bean group is seeking. Moreover the Beardmore layout and present state of output looks more promising for early start than the Harper-Bean group.

MAY PRODUCE SPECIALIZED TIRE

It will be gathered from the titles of the rest of the subsidiary Harper & Bean companies, that they will supply the minor fittings. Why the Harvey Frost Co. figures in the list is not clear, since this company's business has been limited to a tire vulcanizing outfit and materials for it used in garages and by private motorists. Possibly a specialized tire for the group's cars is in contemplation to be made by the Harvey Frost Co.

The estimated yearly business of the Harper-Bean group is valued at \$150,000,000; this estimate being based on a fall of 40 per cent in the present price of cars of corresponding grade and power.

A curious omission from the program of attached producers, concerns the magnetos for the group's cars. The Rushmore company here was originally concerned solely with the Rushmore interests at Plainfield, N. J., but the acquisition of the Rushmore interests by the Bosch Co. of Stuttgart just before the war, put an end to the connection, and the present Rushmore interest here is practically without any specific claim to what the name Rushmore suggests. As a matter of fact the Rushmore company here during the war was limited to an output such as castings and stampings in non-ferrous metals, and certain sheet metal work for aircraft, all of which branches are fully covered and on a vastly larger scale by the Bean company itself.

Possibly it is intended to begin the manufacture of a British Rushmore lighting and starting set, combined with ignition, timer, etc., but the present Rushmore premises in London are totally unsuited and too small for the bulk output necessary.

However, so far as this idea of associating and controlling the output of all essentials is concerned, Whitcomb and the directors are on the right lines, and

moreover they deserve acknowledgment also for their decision to interest their employees by setting aside \$1,000,000 for the workers' benefit on a profit-sharing basis.

MEMBER SOLE DISTRIBUTER

The output is to be distributed solely through the British Trading Corp., Ltd., which body has and is opening and taking over service stations and established garages, having paid, it is reported, some very large sums for certain retail businesses in Manchester, Newcastle and Birmingham. It remains to be seen to what extent this selling body will attract and gain and retain the confidence of, or even have use for the ordinary motor dealer as he has existed up to now.

The fact that this body will be the distributing medium suggests a curious situation, as it may be inferred that besides the Harper-Bean company's profit as manufacturers, there will be an over-riding distribution profit for the British Motor Trading Corp., plus, presumably, the usual discount for the retail dealers. So that the gross Harper-Bean profit will be virtually a double one, viz., directly as makers and indirectly through the subsidiary trading corporation within the group.

It is not clear therefore how this group will be able to sell as cheaply to the public, while they have two head profits to provide, unless having obtained the power over the dealers, they use it to lower their discount rate—usually 15 per cent per car—with the alternative of selling to the public through depots of their own.

PLAN START IN JANUARY

As regards the possibility of dividends, it is noteworthy that the prospectus places the output commencing in January at 50 sets of parts per week, while it is expected to reach 600 sets, that is, as many cars by the end of next December. By July, 1922, the output is estimated at 2,000 sets, that is, chassis, per week.

A turnover of \$150,000,000 is expected in 1923, this estimate being based, it is stated, on a reduction of 40 per cent from the present prices of cars. These figures do not lack the optimistic touch, and time only can verify or disprove them by results. There is one uncomfortable factor lurking in the scheme, namely, the apparent too great reliance on the associated parts and equipment group being able to feed the output steadily. The promoters make it clear that in attacking these smaller feeder companies they believe that it will insure a steady and continuously increasing rate of output, so as to make the company independent of outside supplies.

One has only to look back on the Ford and other large American motor companies' experience in this regard. And I believe I am right in stating that even today there is no large American motor company in such a condition for output as to warrant the statement that it is wholly independent of outside supplies.

(Signed) Englishman.

POSTAL PLANES FIND ALCOGAS ECONOMICAL

*Tests Show Saving of 3.3 Gal.
of Fuel and Power Gain
of 6.5 R.P.M.*

WASHINGTON, Dec. 24—A saving of 3.3 gal. of fuel per hour and a gain of 6.5 r.p.m. plus an important reduction in the use of lubricating oil, are the benefits gained by the Post Office Department from the use of an alcohol fuel for its airplane mail service. The fuel, which is known commercially as Alcogas and composed of 38 parts alcohol, 19 parts benzol, 4 parts toluol, 30 parts gasoline and 7.5 parts ether, was tested in mail plane No. 35, a Curtis R4 machine, equipped with a high compression Liberty 12 engine. A check plane of the Curtis R4 model equipped with a low compression Liberty 12 engine flew the opposite trips during the same period, using high test gasoline.

The following carbureter settings were used:

	Alcohol Fuel. High	Gasoline Low
Compression	Liberty	Liberty
Motor	Motor	Motor
Choke	31	31
Main Jet	145	145
Compensator..	170	165
Well	100	100

Thirty-one flights were made between New York and Washington, a distance of 218 miles, all non-stop flights, on the regular Air Mail schedule between Aug. 4 and Sept. 19, 1919. The flights made by the gasoline ship numbered nineteen. The test was conducted under the direction of J. C. Edgerton, Chief of Flying and Testing, Air Mail Service.

The tests indicate a saving of 3.3 gal. of fuel an hour in favor of the alcohol fuel. At the same time there was a slight gain in engine speed, from 1507.8 revolutions per minute with gasoline to 1514.3 with alcogas.

LOWERS OIL CONSUMPTION

A saving in lubricating oil was also recorded. The average oil consumption with this fuel was 4.4 quarts per hour, as against 4.98 quarts per hour with gasoline, or a net saving of 0.58 quart per hour. This oil saving is thought to be due to the greater thermal efficiency obtained with the alcohol fuel. This does not appear on the face of the charts, due to the fact that high compression motors usually run considerably warmer than low compression motors. As the average on both tables show 167 deg., it is thus apparent that the alcohol fuel shows a relatively lower temperature.

The following is the report of the field manager on the condition of the water in plane 35 after the Alcogas tests:

"Carbon deposit was found to be from $\frac{1}{32}$ to $\frac{1}{16}$ inch thick, soft and flaky. Carbon was thickest on the outside of the piston crown, showing it to be caused by oil rather than incomplete combustion of fuel. Valves were all in good shape. Valve seats showed no signs of pitting or warping. No. 6 connecting rod babbitt bearing cracked in both cap and rod. Two piston rings were broken and six stuck in grooves. Motor in very good shape considering number of hours run."

The high compression motor used in plane No. 35 during all of its flights on alcohol fuel was torn down after approximately 125 hours and was found to be in excellent condition. The carbon deposited was less than that found in a motor using gasoline over a similar period of time.

An analysis of the consumption of the alcohol fuel at various engine speeds is as follows:

1440 to 1460 r.p.m.....	15.9 gal. per hour
1475 to 1480 r.p.m.....	20.1 gal. per hour
1500 r.p.m.....	21.5 gal. per hour
1520 to 1525 r.p.m.....	22.44 gal. per hour

There follows a comparative analysis of fuel consumption with gasoline and alcohol fuel at different engine speeds.

R. P. M.	1440-1460	1475	1500
Gasoline	24	24.17	
Alcohol fuel	15.9	20.1	21.5

There follows a comparative analysis of oil consumption at different engine speeds:

R. P. M.	1440-1460	1475	1500
Gasoline	4.65	4.95	
Alcohol fuel	4.5	4.2	4.2

Motor Truck Use Grows with Roads

PORTLAND, ORE., Dec. 27—How good roads increase demand for motor trucks is interestingly demonstrated by an increase of 63 per cent in Oregon motor truck registrations for 1919 over 1918.

Highway work now actually under contract in Oregon totals \$21,000,000. The greater part of these contracts were let this year. Registration figures complete to the end of October show that 8762 motor trucks are registered in the state, as compared to 5343, in 1918.

Road construction work has of course created a big demand for trucks, mostly of the $3\frac{1}{2}$ ton size. But completion of new highways has automatically increased the demand for trucks, entirely independent of construction work. Oregon truck dealers are all behind on their orders. They look to 1920 to be by far their greatest year.

ELMIRA SHOW IN FEB.

ELMIRA, N. Y., Dec. 27—The tenth annual automobile passenger car show will be held in the Elmira State Armory from Feb. 23 to 28 inclusive, under the auspices of the Elmira Automobile Club. H. S. Bryan, secretary of the club, will be manager.

FRENCH CAR MAKERS OPPOSE 1920 RACES

*Grand Prix for Year Is Called
Off by Automobile Club—
Other Contests*

PARIS, Dec. 13—(Special Correspondence)—Forty-seven French automobile manufacturers having signed an agreement not to race next year, the Automobile Club of France has given official intimation that there will be no Grand Prix in 1920. It intimates, however, that there will be one or more important speed contests in 1921.

The French manufacturers who are quoted as representing the opinion of the majority in France comprise 27 who have never taken part in a speed contest of any kind anywhere. Five of them are truck manufacturers who never have built a touring car. Of the remaining 20 there are five which raced years ago, but which for the last ten years have been bitter opponents of all speed contests, and indeed of competitions of all kinds. Two others have never built anything but miniature cars.

Despite this official decision of the French makers, racing cars are being built, and will be entered in contests abroad. One of the firms having signed against racing has a set of 183 cubic inch racing machines in a very advanced condition. These will be sent to Indianapolis and probably will be run later in the year in the Italian road races.

THE INDEX

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ERIE SHOW IN JANUARY

ERIE, PA., Dec. 27—Erie's annual automobile show will be held in the Overland-Erie garage, Jan. 13 to 17, under the auspices of the Erie Automobile Dealers' Association. A. L. Nelson will be show manager.

SEATTLE SHOW MAR. 1-8

SEATTLE, Dec. 27—Seattle's annual automobile show will be held Mar. 1 to 8 in the State Armory, under the auspices of the Motor Car Dealers' Association. William J. Coyle has been selected as manager.

PITTSBURGH SHOW IN MARCH

PITTSBURGH, Dec. 27—Pittsburgh will hold a show for passenger cars and equipment in Motor Square Garden, Mar. 20 to 27, under the auspices of the Automotive Association, Inc. John J. Bell will be show manager.

FORD PLANS 50,000 BRITISH PRODUCTION

Will Make Complete Cars and Tractors in England from Raw Materials

LONDON, Dec. 11—(Special Correspondence)—There have been important changes in the Ford company's British personnel, the chief one being the now entire severance of the connection of Sir P. D. Perry with the company, both at Manchester and at Cork. The latest information is by way of an official statement just issued by W. C. Anderson, Perry's successor as managing director of the Ford Motor Co. (England), Ltd.

Anderson has returned from the U. S. A. accompanied by F. L. Klingensmith, vice-president of Ford Motor Co.; C. E. Sorensen, general manager of Henry Ford & Son, manufacturers of the Fordson tractor, and other officials connected with the Ford interests. They were met on arrival at Liverpool by W. H. Smith, Ford research engineer.

These gentlemen have been engaged in a survey of manufacturing conditions and possibilities throughout the United Kingdom, and as a result of the conferences which have taken place important decisions have been made.

Anderson states that the complete manufacture of cars and tractors from raw material in Great Britain will be pushed forward with the utmost possible speed. Every effort will be made to secure that in the near future Ford cars and Fordson tractors sold in the United Kingdom will be wholly manufactured in the United Kingdom.

In pursuance of this policy it has been decided that all profits which, in the usual course of events, would be paid out to shareholders, will remain in this country for reinvestment in British industry. As the manufacture of parts hitherto imported increases, the amount of British labor will necessarily increase proportionately.

The matter of wage rates has again been under review and the scale adjusted to provide for considerable increase. The minimum rate for adults of 50 cents per hour, including 6 cents share of profits after one month's probation, is to be advanced to 82 cents per hour according to the merit of the individual.

The working week of 40 hours which was started this year will be altered to 44 hours, to secure additional production as soon as increased supplies of material warrant the change. The company's officials are busily occupied in scouring the country to find sources of materials required. It is hoped that co-operation with producers of iron and alloy-steels will ensure results in the form of material matching those which have been evolved in America, following the years of research and experiment by Ford and his engineers.

The annual output of complete cars aimed at is 50,000, and in addition closed bodies for exportation to Continental countries will be manufactured in this country. Factory developments at Copenhagen and Cadiz are now proceeding apace. The remaining sales and service stations at Brook Green, Hammersmith, London, has been sold to International Motors Ltd., who have been appointed dealers. Since 1909 about 79,000 Fords have been disposed of in Great Britain.

Publication of this issue of Automotive Industries has been delayed until Jan. 7 by conditions over which the publishers have had no control. Further issues will be forthcoming as rapidly as they can be printed.

S. A. E. Hears Merits of Aluminum Parts

INDIANAPOLIS, Dec. 27—The use of aluminum is rapidly spreading throughout the automotive field. Fitting aluminum connecting rods directly to a steel crankshaft without intervening bearing metal; forged aluminum crankshafts and flywheels; aluminum disk wheels for passenger cars and trucks; all aluminum engines, and plating aluminum pistons with pure iron are among some of the interesting things under development by the industry, as outlined in a talk given by R. E. Carpenter of the Aluminum Castings Co. of America to the S. A. E. Indiana Section.

In the discussion, Louis Chevrolet, who has been a strong exponent of aluminum alloys, gave a short talk on the success he has had with them and F. E. Moskovics, vice-president of Nordyke & Marmon Co., intimated that the future engine for passenger car work might be an aluminum affair of the fixed radial type with an overall width of less than 6 in. He stated that at least two makers were now experimenting with such an engine.

OPENS EXPORT OFFICE

NEW YORK, Dec. 27—The Hill-Smith Metal Goods Co., of Boston, Mass., manufacturers of repair parts for Ford, Overland and Chevrolet cars, have just opened their export department at 38 Water street, New York. This is a further development of the company's expansion along export lines. Their branch office in Havana has been most successful. Early in January the president of the company sails for England, France and other European countries to investigate sales possibilities for his company.

NOVEMBER EXPORTS TOTAL \$741,000,000

Exceed October by \$109,000,- 000 and Bring Year's Total to \$7,242,000,000

WASHINGTON, Dec. 24—The marks set by both exports and imports in November were the second highest in the history of American foreign trade, according to an announcement made today by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

The value of exports for the month was \$741,000,000 as compared with \$632,000,000 for October, and \$522,000,000 for November of the previous year. For the 11 months ended with November, the total value of exports was \$7,242,000,000, against \$5,583,000,000 for the corresponding period of 1918.

Imports in November amounted to \$429,000,000, against \$402,000,000 in October of this year, and \$251,000,000 in November of last year. For the 11 months of this year, imports were \$3,528,000,000 compared with \$2,820,000,000 in the first 11 months of last year. If the foreign trade continues in December at the same rate as in November, the imports for the calendar year will approach \$4,000,000,000 in value and the exports \$8,000,000,000.

The excess of exports in November amounted to \$312,000,000 for the 11 months to \$3,714,000,000, nearly \$1,000,000,000 more than in the 11 months of 1918.

British Engineers Split on Standards

LONDON, Dec. 5—(Special Correspondence)—The British Engineering Standards Association Committee has again considered the question of limits round the nominal line. This committee, appointed as a result of a trade conference in April last, to draw up a standard system of limit gaging applicable to all classes of engineering, apparently finds the difficulties besetting the subject increasing rather than diminishing as they delve deeper into it. The replies received to a questionnaire sent out to a number of firms, asking which method of hole tolerance distribution they preferred, that is, that which gave plus and minus tolerances, or that which provided for plus tolerances alone, brought in only some 200 replies, these being almost equally divided in favor of the two methods. The problem is rendered still more complex in that, among the advocates of each of the systems, are large firms of importance and influence.

The members were, as a result of the discussion, unanimous in feeling that no decision could be made until further light had been thrown on the subject.

LAKES TO GULF ROAD WITHIN TWO YEARS

Jackson Highway Official Announces Great Project to Be Finished in 1922

NEW ORLEANS, Dec. 27—The Jackson Highway, which is to connect New York state, starting at Buffalo, with the Gulf Coast, its southern terminal being New Orleans, will be completed in about two years, according to the announcement by Col. T. C. Campbell, vice-president of the Jackson Highway Association and representative of that organization in Louisiana and other parts of the South. An inspection tour of the road, which is now completed into Tennessee, is planned for the spring, following the meeting of the directors and representatives of the Jackson Highway Association from the various states through which it passes, to be held in New Orleans.

Leaving Buffalo, the highway parallels the southeastern shore of Lake Erie to Cleveland, where it turns southward through Ohio and Kentucky to Lexington, and thence westward to Louisville, where it is joined by the Chicago branch of the same highway, which comes down through Illinois and Indiana. The highway then crosses Kentucky southward to Nashville, Tenn., and on down to Mount Pleasant, whence one branch goes south to Montgomery, Ala., and southwest to Mobile, and parallels the Gulf coast into New Orleans. The western branch, leaving Mt. Pleasant, crosses the northwest corner of Alabama, almost the entire length of Mississippi, and enters New Orleans through Covington, La.

The entire road is passable, and was followed by army engineers in an automobile in 1917-18, but is fully completed only from Buffalo through Tennessee to the Alabama line. The Louisiana link, from New Orleans around the southeastern end of Lake Pontchartrain, is being completed as rapidly as possible, while Tennessee and Alabama are working on their sections. The Jackson Highway probably will be the first north and south trans-United States highway to be completed into New Orleans.

Packard to Exhibit

Export Built Cars

NEW YORK, Dec. 28—In accordance with its new international policy the Packard Motor Car Co. will hold a special Packard Export Exhibition at its headquarters, Broadway and Sixty-first street, from Jan. 3 to 10, inclusive.

A number of Packard twin-sixes, both closed and open models, finished

specially for the export trade, and of a type for which there is an increasing demand abroad, will be the main feature of the exhibition.

The building will be decorated for the occasion with the arms and standards of all nations, and corps of interpreters will be on hand to render first aid to any visitor not entirely familiar with American automobile terms. Invitations are being mailed to all local export men and their friends from abroad, but anyone interested in the specially finished Packards is invited to attend.

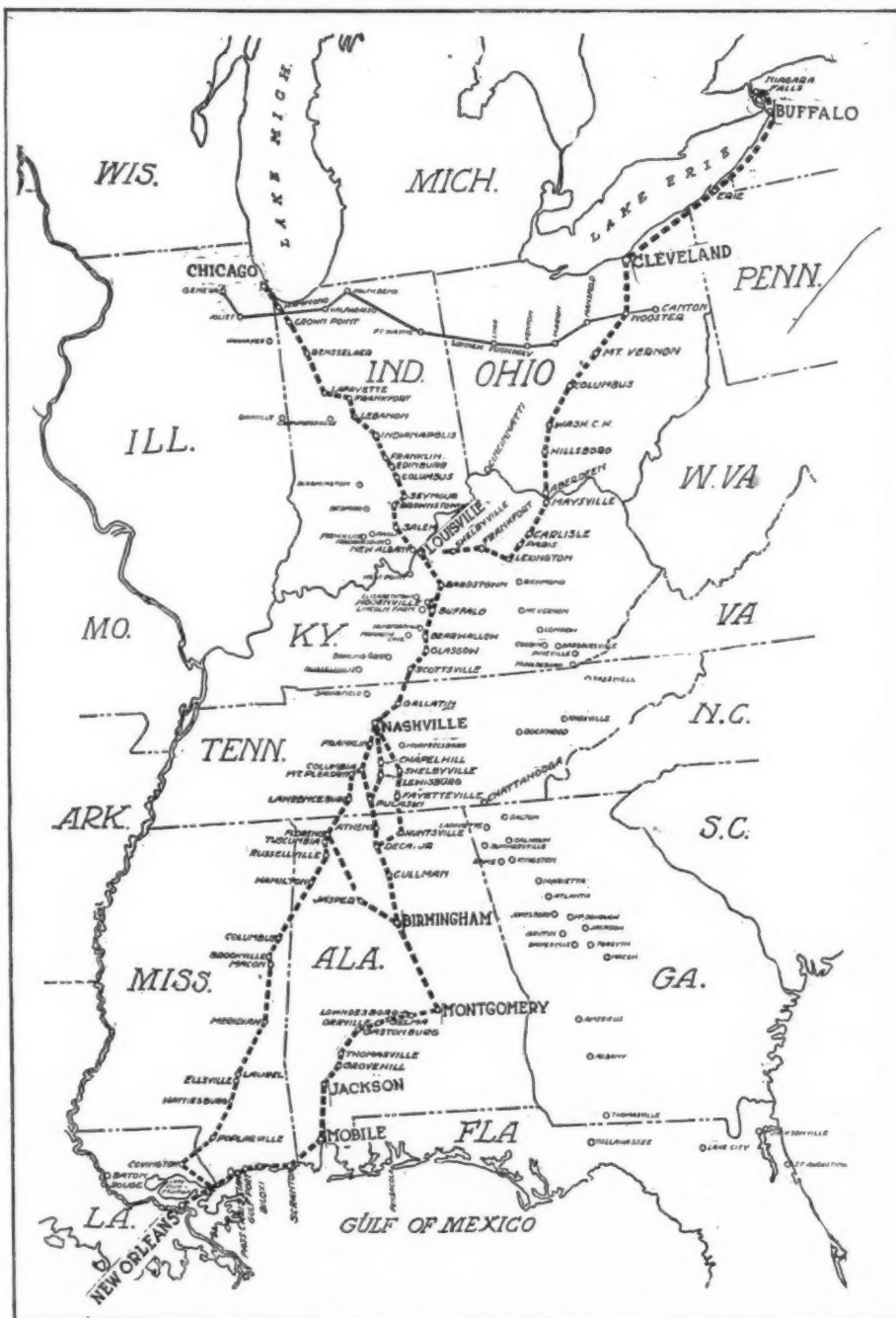
It is the plan of Fred Cardway, export manager, to make the exhibition an annual event. The car show will in all probability be followed by an ex-

hibition of trucks specially designed for overseas service.

PLAN PHILLY BUS LINE

PHILADELPHIA, Dec. 26—One hundred gasoline motor buses to operate on Broad street from League Island, the seat of the Philadelphia Navy Yard, and the Parkway for a 5-cent fare and free transfers over the entire system is a plan now under consideration by the Public Service Commission. Application for a certificate of public convenience for the transportation concern has been made by General Russell Thayer. The company has not been named. The plan is to invest \$1,000,000 in 100 gasoline buses, each seating thirty passengers.

Jackson Highway—A Lakes-to-Gulf "Main Street"



This map shows the proposed Jackson Highway, several links of which have been completed, which will furnish an automobile route connecting Buffalo, Chicago and intermediate cities with New Orleans

STUDEBAKER TO MAKE LIGHT SIX CAR

Announce Specifications of New Car to Be Placed on Market

SOUTH BEND, IND., Jan. 2—An entirely new small 6-cylinder car has been completed by the Studebaker Corp., and will be marketed during the coming year as the Studebaker Light Six. It is a machine of 112 in. wheel-base with a block motor of 3½ in. bore by 4½ in. stroke, rated at 40 h. p. The complete car will be manufactured in the new South Bend works.

The engine cylinders are cast in a block with the top half of the crankcase, and the lower half of the crankcase is a steel pressing. Three point suspension is used. Connecting rods are 10 in. long, which is an unusual length for a motor having a stroke of only 4½ in. The crankshaft is supported in four bearings, as is the camshaft. A noteworthy departure in quantity production cars is the finishing of the crankshaft and connecting rods all over, which is done to insure the best possible balance.

The engine has a detachable aluminum head, with integral water jackets, which contains the horizontal portion of the intake manifold. The horizontal outlet Stromberg carburetor is bolted directly to this head. The valve openings are so located that the incoming gases, after passing through the valves, are directed against an unjacketed portion of combustion chamber wall for thorough vaporization of the fuel. The valves are arranged at an angle of 20 deg. to the vertical, and are operated through bell cranks carrying roller cam followers.

There is a triangular camshaft and accessory drive at the forward end of the engine through a Morse silent chain. The electrical system is of the two unit type, the starting motor driving to the flywheel through a Bendix drive. Lubrication of the engine is by the circulating splash system.

The clutch is of the single dry plate type. Between the clutch and transmission there is a flexible disk coupling. As on the Studebaker 4, a separate transmission unit is employed, supported on a subframe at 3 points. This subframe, which also supports the engine, slopes downward toward the rear so as to insure a straight line drive when the car is loaded. The drive is through a tubular propeller shaft, with two universal joints.

The frame is made of 6 in. steel channels, and widens gradually from front to rear. The rear axle is of the semi-floating type, and the connection between the axle and the frame is that corresponding to the Hotchkiss drive.

The light six is made in three body styles, a 5-passenger touring car, weigh-

ing 2,400 lbs., a 5-passenger four-door Sedan, and a 3-passenger landau-roadster, which can be converted into an open 3-passenger roadster. The body is finished in black enamel, and upholstered in French leather. Inside and outside door handles are used. The steering wheel is walnut finished. There are two plate glass windows in the rear of the gipsy top. Tire equipment is 32x4 cord tires all around.

Five sample cars were built and submitted to extensive block and road tests, an aggregate road mileage of 50,000 being run up. Each of the four road wheels carries an equal share of the total car weight of 2,400 lbs.

French Find German Markets Cheapest

PARIS, Dec. 6—(Special Correspondence)—French Government encouragement is being given to purchases in Germany. A government department which is making collective purchases for the devastated areas and the liberated regions, has placed its first order in Germany, this being for machinery and building material. This Government department has already spent \$380,000,000, of which \$340,000,000 were in France, \$10,000,000 in America, and \$30,000,000 in England. Partially owing to the high purchasing value of the franc in Germany and its low value in America and England, it has been decided to place orders in the late enemy countries.

Up to the present very few German automobiles have come into France. Many German cars are to be seen on the streets of Paris, but these appear to be machines from the reconquered provinces of Alsace and Lorraine, which are allowed to travel with their old German numbers.

The Fiat Co., of Turin, Italy, has placed an order of several million dollars with the Deutsche Maschinenfabrik for the supply of very complete rolling mills.

Michelin Produces French Cord Tire

PARIS, Dec. 6—(Special Correspondence)—Michelin has just placed on the market a cord construction tire. This is being built with clincher bead and in two sizes only for the present: 880 and 820 mm. diameter. The tire will be sold at 35 per cent increase on the fabric construction. This is the first cord tire to be produced in France.

THE INDEX

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TEST DANGERS OF GAS IN TUNNELS

Bureau of Mines Asks \$100,- 000 Appropriations for Ex- periments and Remedy

WASHINGTON, Dec. 26—The proposed construction of vehicular tunnels in several of the large cities of this country and particularly the tunnel between New York and New Jersey has created a problem regarding the amount of carbon monoxide likely to be discharged by automobiles in such tunnels, and as a result the Bureau of Mines has requested \$100,000 from Congress to conduct experiments. At the same time Yale University will construct an experimental tunnel and co-operatively attempt to determine whether the poisonous gases thrown off by automobiles would be detrimental to life or seriously endanger it in a long tunnel. The Bureau of Mines will conduct its experiments at Pittsburgh.

THE HUDSON TUNNELS

The problem has been concretely developed by the proposed tunnel under the Hudson River and between New York and New Jersey, which will be 9,000 ft. long, with an estimated number of 2,000 passenger cars and trucks passing through per hour during the rush periods. The quantities of poisonous gas given off by this long line of machines is now an unknown quantity, and must be determined before the tunnel construction can be undertaken, so that it will be a known factor and the proper ventilation may be installed.

In discussing this matter with Congress, Van H. Manning, Director of the Bureau of Mines, emphasized the need for vehicular tunnels to handle the rapid increase in the use of automobiles.

Makes \$22,000,000 Sale in 20 Minutes

In a message of thanks to AUTOMOTIVE INDUSTRIES for its assistance in building up the business of the Traffic Motor Truck Corp., the company announces that it booked orders for \$22,000,000 worth of Traffic trucks for 1920 delivery, in less than twenty minutes recently.

Announcement is also made by the company of an increase in wages to employees under which the minimum wage is increased to \$5 a day.

COAL SHORTAGE CUTS FRENCH PRODUCTION

Night and Day Shifts Em- ployed to Lessen Strain on Power Plants

PARIS, Dec. 2—(Special Correspondence)—Owing to the shortage of coal, output has been restricted in the French automobile industry, and particularly in the Paris region. With very few exceptions the automobile factories in and near Paris are run by electricity and obtain their current from a couple of companies. The total power available is more than 300,000 h.p., but owing to war growth this is barely sufficient, and now that coal is scarce requirements cannot be met.

In order to get over the shortage, arrangements were made among manufacturers for their works to be run alternately day and night. This arrangement went into effect early in November, and has been only a partial success. Its immediate effect was to cause all the small and medium size factories to find means of dispensing with current furnished by the supply companies, in order not to have to work nights.

Large numbers of these small shops have installed gasoline motors and generators, or are driving direct from gasoline engines. In some cases agricultural tractors are being made use of to drive factory and shop machinery. At the headquarters of the American Red Cross, where current is only used for lighting, George H. Robertson, who is in charge of transportation, has installed a French army machine shop truck to supply current when the main supply fails. This truck stands out in the street and its engine is started up as soon as the lights go out, which happens rather frequently.

In other cases kerosene and heavy oil engines are being made use of, but their number is restricted. Until a recent law went into effect fuel oil paid such a high duty that its use was prohibitive in France. It is now admitted practically duty free, and arrangements are being made for its extensive use for heating and power. Few heavy oil engines exist, however, and until they are built, or imported, not much relief can be expected from this quarter.

The net result of the adoption of gasoline and other engines for the small factories around Paris has been that a considerable amount of current has been made available for the larger establishments, and night shifts have not always been necessary.

Among the automobile factories there is a tendency to adopt their own generating stations. Panhard & Levassor are laying down a big generating station. Renault is doing the same, and Ballot is extending his Diesel engine equip-

ment for driving his factory. Under the new law admitting fuel oil free, the use of Diesel and semi-Diesel engines may be expected to take a considerable extension.

One of the incidental features of this situation is that mechanics in many cases are working two shifts, for two different firms. If their own factory is on day shift, they work elsewhere at nights, thus putting in 16 hours work and having 8 hours for sleep. Young men are tempted to do this by the high wages prevailing. Factory heads are finding it difficult to put a stop to this practice.

Westinghouse Company Forms Export Department

PITTSBURGH, Jan. 1—To provide facilities adequate to handle increasing export business and to develop foreign trade to a greater extent, the Westinghouse Air Brake Co. has organized an export department with headquarters in the Westinghouse building, Pittsburgh.

The new department will begin active operations Jan. 1, with E. A. Craig as export manager. Craig has been associated with the Westinghouse company thirty-two years. In 1905 he was appointed auditor and assistant secretary and in 1906 was made southeastern manager.

This department will be represented in the New York office by W. G. Kaylor and in South America by R. M. Oates.

Edge Export Bill Signed by Wilson

WASHINGTON, Dec. 27—President Wilson has signed the Edge export finance bill, which provides for the extension of credit to foreign markets through the virtual internationalization of an extended American banking system, according to an announcement made at the White House today.

The bill was signed last night. The new law will open up world markets for foreign trade, according to its proponents, and is expected to speed up American production on a large scale. It authorizes the creation of corporations for financing American export trade.

It makes possible the sale of American products on credit to penniless foreign nations and yet provides for obtaining actual cash for pay rolls and the purchase of raw materials for exporting manufacturers.

What is regarded as its strongest feature is the latitude allowed corporations organized under the new law. Under the federal reserve law national banks are not allowed to rediscount long term notes. The law allows concerns organized in accordance with its provisions to take the long-term paper and instead of rediscounting it, to use it as collateral.

LEFTHAND DRIVE MAY LESSEN CAR EXPORTS

Possibility of Restrictions by British Authorities Is Noted in London

LONDON, Dec. 5—(Special Correspondence)—American makers exporting cars to the British market should note that the attention of the Legislature has been drawn to the increasing number with left-hand steering now being delivered. Opinions of users seems generally indifferent on the matter, but there is the possibility of influence being brought to bear on the Government Department concerned to the detriment of their import.

Meanwhile it may be noted there is no certainty that British law forbids the left-hand steering position, the nearest reference to the question being found in two paragraphs of the "Use and Construction Order" (Motor Car Acts). The first lays down that:

"The motor car and all fittings thereof shall be in such a condition as not to cause, or be likely to cause, danger to any person on the motor car, or on any highway."

The second reference reads:

"He (the driver) shall not, when on the motor car, be in such a position that he cannot obtain a full view of the road and traffic ahead of the motor car."

There are minor regulations which strictly do not affect the matter as part of the general law. For instance, the (London) Metropolitan Police must pass a taxicab before use. If a "left-hand drive" vehicle were refused (which possibly would be the case if tendered) it would be obviously illegal to use that vehicle, as a taxicab in London.

BRITISH STRIKE CONTINUES

LONDON, Dec. 5—(Special Correspondence)—The failure to bring the employers and molders together with the object of settling the present strike, has accentuated the general unrest in the engineering trades at large. Scores of factories are being run on short time, including railway works, where there is a pressure of repair work and new construction to meet the demand for increased rail facilities, etc.

In the motor trade efforts have been made to import castings, but the other trades are refusing to handle these castings, at least this is the case in some factories, an exception being made before the show to enable chassis to be got ready for that event. All the government seems able to do is to continue stating that they are watching the affair with "critical and careful consideration." Between 80,000 and 100,000 men are now out of work by this strike.

OREGON LAW CAUSES RISE IN GASOLINE

Price Goes Up Because of Gravity Test Required— Repeal Considered

PORTLAND, ORE. Dec. 27—Oregon motorists are now "enjoying" an extra charge of 1½ cents more per gallon for gasoline than their fellow motorists of Washington and California have to pay. It really figures up 2½ cents more per gallon, because of a state tax of one cent per gallon levied by the last legislature for the state highway fund.

The Standard Oil and Union Oil companies have just added 1½ cents per gallon to the price of gasoline in Oregon, and the Shell and Associated Oil companies are expected soon to follow suit, because of the Oregon law which requires that gasoline sold in the state must test 56 specific gravity, Baume. So far as known here, no other state in the country requires such a test.

The oil companies declare the increase is necessary to meet the additional cost of putting the Oregon gasoline through a special refining process, of shipping it in special tanks to keep it separate from gasoline sold in Washington, and of storing it in separate storage tanks. They assert that even 1½ cents per gallon doesn't cover these additional costs and that Oregon motorists may have to face a still further increase in the near future.

Washington, California and other Pacific coast states have dropped the old specific gravity test, which the oil companies assert is meaningless, so far as power value is concerned, and base their tests on the United States government specifications, which are based on boiling points. The gasoline sold in California and Oregon is of about 54 specific gravity.

But the increase in price isn't the worst of it. As there is no market elsewhere for the special test gasoline required by Oregon, according to the oil companies, they make only enough of this specially refined product to supply the immediate needs of the state. One result is that any delay in shipments causes a gasoline shortage here.

Last fall the shortage became so acute that the only gasoline left in Portland was the stock actually in the service station tanks, and many towns in the interior were entirely without motor fuel. At that time Governor Olcott suspended the law for 15 days to permit the oil companies to bring in gasoline of lower specific gravity from Washington to tide over the emergency. But the companies declare such a situation may occur again at any time in the future, despite the increased price.

Governor Olcott recently called a special session of the Oregon legislature for January. The gasoline law is cer-

tain to be one of the matters brought before it.

At present motorists in Portland have to pay 25 cents a gallon for gasoline, which includes the one cent state tax per gallon. Just across the Columbia river in Vancouver, Wash., only nine miles away, gasoline costs only 22½ cents. The Washington gasoline appears to give just as much satisfaction as the higher priced special-process Oregon motor fuel.

Benzol Successful in British Trials

LONDON, Dec. 5—(Special Correspondence)—The 10,000 mi. run of a 16 h. p. Sunbeam "four" (80x149 m.m.) using British benzole exclusively, has ended successfully. The average mileage was 24.57 a gallon (British). On examination only a small amount of carbon was found on the piston heads, and in all respects there was no evidence of injury from the fuel. The Automobile Association and Motor Union were responsible for the test, which was officially conducted throughout. It began on Aug. 28. The current regulated price of benzole is 66 cents per British gallon in two-gallon tins, which is 7 cents cheaper than the current price of ordinary gasoline in England.

Non-Ferrous Metal Combine Announced

NEW YORK, Dec. 27—The American Metal Co. has acquired the entire business of the L. Vogelstein & Co., Inc., an independent metal producing and trading corporation. Among the Vogelstein holdings taken over is the Copper Refinery at Chrome, N. J., the controlling interest in which was secured recently by purchase from the U. S. Smelting, Refining & Mining Co.

L. Vogelstein has been elected a vice-president of the American Metal Co. He acquired a substantial interest in the American Metal Co. at the recent sale of shares by the Alien Property Custodian.

INDUSTRY TOTAL GROWS

WASHINGTON, Dec. 26—An increase of 4.8 per cent in the wages paid in September, 1919, as compared with an increase of 27.3 per cent in the numbers employed during that month as against September, 1918, is reported by forty-four automobile manufacturers to the Department of Labor. The forty-four employers had 119,186 men, earning \$3,505,294 in September, 1919, as against 93,623 earning \$2,489,868 in September, 1918.

Forty-two employers report 116,183 workers on the pay-roll in September, 1919, as against 109,841 in August, 1919, an increase of 5.8 per cent, while the September pay-roll, \$3,404,286 against \$3,031,287, increased to 12.3 per cent.

PLAN JULY AIRCRAFT SHOW AT OLYMPIA

All Types of Machines to Be Exhibited at Interna- tional Event

LONDON, Dec. 3—(Special Correspondence)—An international aircraft exhibition will be held at Olympia, London, next July. It is anticipated that every type of machine will be represented, and it is hoped also to make provision for trials and demonstration flights at an aerodrome within easy distance of the show.

Before the war a successful—but not financially successful—series of aero exhibitions was held by the Society of Motor Manufacturers and Traders at Olympia, the first being held in 1909. Owing to the growth of the British aircraft industry during the war, the aircraft firms have formed a separate body, the Society of British Aircraft Constructors, which comprises in its membership practically every British manufacturer of aircraft, aircraft engines, and their component parts, equipment and materials. This body has entered into an agreement with the Society of Motor Manufacturers and Traders under which the pre-war aero exhibitions will be continued under the joint management of the two societies. The arrangements provide for the setting up of a joint committee to promote aero exhibitions in the United Kingdom and the use of the exhibition organization maintained by the Society of Motor Manufacturers for the carrying out of its annual motor and other exhibitions.

WEST INDIES FAVOR TRUCKS

WASHINGTON, Dec. 24—There is an increasing use of motor vehicles in Martinique, French West Indies, according to a report from Consul Wallace. On Sept. 1, 620 automobiles and 69 trucks were registered there, fully one-fourth of the trucks being used in and about the sugar factories and distilleries. Since the distilleries are located in the interior some distance from a seaport and are only reached by roads, which, although good, are over very high hills, the advent of the truck has been of great benefit. Besides carrying the products of the factory to the port, the trucks also take supplies to the settlement in which the distilleries are located.

Postal service for Martinique is now maintained by motor cars, which carry passengers as well as mail, thus adding greatly to the facilities of the island, making it possible to visit any important point from Fort de France daily and with comfort.

CITROEN TO REMAIN IN FRENCH CONTROL

General Motors Negotiations Broken Off—Owner Charged with War Profiteering

PARIS, Dec. 4—(Special Correspondence) — Citroen production is growing. During the month of October 750 cars were produced; the number was 1,000 for November, and is expected to be 1,200 for December and 2,000 for January. As will be seen, the firm is still a long way behind its estimated production of 100 cars per day.

During the past few weeks negotiations have been in hand for the absorption of the Citroen Co. by General Motors. These negotiations were made possible by the fact that a large number of the General Motors officials were in Paris. Finally all negotiations were broken off, and the Citroen concern remains in French hands.

It has been decided, however, to form a fresh company, with a capital of \$2,000,000, to be known as the "Credit Auxiliaire de l'Industrie Francaise," with the object of "forming stocks of raw materials, parts and accessories necessary for the manufacture of Citroen cars." Among the leading stock holders are M. Clément-Bayard, the Crédit Français Bank, M. Charron, and the French Branch of Gaston, Williams & Wigmore, who are Citroen distributors for England.

M. CITROEN UNDER CHARGES

Charges have been brought against M. Citroen of having obtained payment from the French government of sums of money to which he was not entitled, when he was entrusted with the management of the State Arsenal at Roanne, in 1918. A government commission was appointed, and according to its finding Citroen received an excess payment of 843,526 frs. 29c. The report concluded with the suggestion "that the government should take legal action against M. Citroen for a refund of the excess amounts which were paid to him when he was entrusted with a special mission at the Roanne Arsenal, in July, 1918."

This matter is an echo of the war. In early 1918, Loucheur, then Minister of Armaments, entrusted Citroen with the task of increasing the production of 75 mm. shells at the Roanne arsenal. Citroen became technical director of the 75 mm. shell factory and was independent of the general manager of the arsenal. Contracts were placed by him, either in his own name or on behalf of the government, independently of the arsenal. In some cases orders were placed with Citroen's own

factories for material to be delivered to the arsenal. The total of these orders placed by M. Citroen amounted to nearly 6,800,000 francs, of which 5,800,000 was for tools or machinery for manufacturing 75 mm. shells.

According to an inspector's report, the value of this material delivered to the Arsenal was 4,132,193 francs, making a loss to the state of 2,444,606 francs. Citroen was paid interest at the rate of 6 per cent on all the money he laid out for the State to cover purchases made. In some cases this interest was paid before the orders had been officially placed.

The government experts appointed to enquire into this matter reduced the total of the orders to 5,357,159 francs 67c. and the value of the material delivered was increased to 4,523,633 frs. 38c., thus leaving a sum of 843,526 frs. 29c. paid in excess. It is this sum that the government is seeking to recover.

OWNER JUSTIFIES CHARGES

In an interview on this subject Citroen protests against the action which has been taken. He states, "When I was asked to take charge of this work the German army was threatening Paris. Quick action was necessary. By old administrative methods I could have covered my own responsibility, but the army would not have received the shells it needed. I was authorized to purchase with my own capital, as the representative of the government, all that was necessary for the arsenal. Before I took up this job the arsenal had only produced 1,170 shells, and its maximum daily output was 1,000 shells. Within three months after my arrival the output was 40,000 stampings and 8,000 finished shells per day. Now that the danger is over the authorities are making comparisons between the prices I had to pay during the height of the crisis, when every minute was precious, with those obtainable by Government departments which have the time to solicit tenders and select the most advantageous. It was impossible to do this and give the nation the shells it needed."

THE ROANNE ARSENAL

The Roanne arsenal is the biggest war factory in France. It consists of three buildings 984 feet in length by 820 feet in width, each one covering an area of 808,000 square feet. There was built around it a town with houses for 1000 families of 3 to 4 persons, and quarters for 1500 bachelors. In addition there was a camp for 3,500 workmen. The bakeries produced 6 tons of bread per day, and the biggest dining hall seated 4,500 people at one time.

This arsenal, which has iron, steel, and bronze foundries, and huge machine shops, cost \$25,000,000. At the present time it is being used for repairing railroad cars, but the output is declared to be only one per day.

MANY TRUCKS IN MID-WINTER TOUR

Route Through Wisconsin Cities to Milwaukee Shows Is Laid Out

MILWAUKEE, Dec. 29—Thirty motor trucks have already been entered in the big mid-winter demonstration tour to be conducted by the motor truck division of the Milwaukee Automobile Dealers, Inc., as a corollary of the twelfth annual Milwaukee show, Jan. 19 to 25, in the Auditorium.

The tour will cover about 300 miles and consume three days, ending at the Auditorium about the time the show is formally opened on Jan. 19. The first day, Jan. 17, the route will be from Milwaukee to Sheboygan, with Port Washington as the noon control. On the second day, the caravan will travel from Sheboygan to Fond du Lac, with Plymouth as the noon stop. On the third day, the route will be from Fond du Lac to Milwaukee, with West Bend as the main stop. It is expected that the finish will be in time to place the participating trucks on display in the truck show, in Machinery hall, for the inspection of the first night crowds.

"The idea of a mid-winter tour in the snow belt will bring some of the foremost truck men of America to Milwaukee for the purpose of studying the various conditions under which the trucks operate during the expedition," said Bart J. Ruddle, manager of the show and secretary of the dealers' association. "Our plans are attracting wide attention and representatives of factory engineering departments, as well as investors about to inaugurate long distance transport routes are coming to analyze the results by the Milwaukee pioneers in mid-winter transportation and apply it to other localities in the northern belt."

Arrangements are under way for addresses and motion picture exhibitions concerning motor truck transportation under varying conditions, in the principal movie theaters of each city where noon and night stops are made. Prominent speakers are being selected to exploit motor trucking, its benefits and necessities.

Tire manufacturers making pneumatic truck casings have offered to furnish service cars to accompany the tour.

Interest in the motor show proper is greater than ever before, as is indicated by the fact that every square foot of space in the Auditorium available for display purposes has been taken, giving an aggregate of 125,000 sq. ft.

KRIEG LEAVES PAN MOTORS

SAINT CLOUD, Dec. 22—A. Krieg has resigned as chief engineer and general manager of the tractor division of the Pan Motor Co., Saint Cloud.

Truck Parcel Post**Lowers Living Cost**

WASHINGTON, Dec. 27—Aside from the indication that new communities are coming to life, a statement covering recent activities of the motor vehicle truck service, made public by the Post Office Department, shows an actual saving of 43½ per cent on produce to the consumer by parcel post.

In spite of the popular belief that the high cost of living can not be reduced while there is a middleman, post office officials declared yesterday in supplementing the statement that the services of a middleman were required in every instance whereon the 43½ per cent saving was computed. It is not the intention of the Post Office Department to eliminate the middleman, but rather all unnecessary handling of a product in transit.

Warsaw, Va., a rich farming community, 248 miles from Washington, was opened to new opportunities by the post office motor service, officials declared. Eggs can be shipped parcel post from Warsaw to Washington from 15 to 18 cents cheaper than the minimum retail price quoted on the local market. More than 2,000 dozens of eggs were brought from Warsaw to Washington Nov. 12 and sold at 63 cents a dozen, while the retail price was 78 cents a dozen.

A great saving also is shown on potatoes, which cost \$1.15 a bushel by parcel post and \$2.20 a bushel in the market. Apples from Purcellville, Va., by parcel post cost \$1.08 a bushel, while the same fruit purchased in the local market cost \$3 a bushel.

Wait for Hunger to**End British Strike**

LONDON, Dec. 11—(Special Correspondence)—There was a ray of hope last week that the strike of the iron moulders would be settled, but it has proved to be baseless, and events are beginning to look threatening. The masters appear to be counting on an early collapse of the strike because of the approaching bankruptcy of the men's society from which they have been getting strike pay, and the men's knowledge of this attitude is not tending to smooth the issue. They declare that if hunger forces them to capitulate, they will curtail output.

Meanwhile the strike is having a most disastrous effect on all branches of engineering industry, and attempts to import castings have been partly frustrated by the other trade unions refusing to handle them in the machine shops. Accordingly there are thousands of machine men and fitters now out of work for lack of castings, and Coventry, the seat of the British motor trade, is among the worst hit.

The agricultural implement trade is perhaps the most punished, because cast-iron is used so largely for land im-

plements. The Smithfield Club Show of cattle and farming plant is being held this week, for the first time since 1915, and the effects were learned today of the big hold-up that this strike is causing in that trade.

So far as an outsider can judge, the blame is pretty evenly divided between the masters and the men, the masters for lack of foresight in not modernizing their plant and methods, and the men for not expediting production.

The British foundry trade both in iron and brass has failed to advance with the times, and at the outset of the war some most primitive methods were in vogue. The use of moulding plant, rammers and even core-making machines was only beginning, and were it not for the war's needs, probably matters would have remained unaltered.

Not merely was there an absence of labor-saving and output expediting machinery, but the very shops were mainly as gloomy and ramshackle as grime and age could make them. Here and there one saw an up-to-date foundry, and the fact impressed itself all the stronger by contrast with the general state of other foundries. With such ill provided foundries, what hope can there be for increasing output?

(Englishman)

Murray Plans 1,500**Output in Newark**

NEW YORK, Dec. 27—Production of 1,500 cars in the first year, for which orders have been received, is planned by the Murray Motor Car Co., of Newark, N. J. The factory equipment has been moved from Pittsburgh to the new plant now being erected on the 4½ acre plot on Frelinghuysen avenue and the Pennsylvania railroad in Newark.

Only a few minor changes will be made in the Murray for 1920, according to E. H. Worne, general manager. A Murray service station is being maintained at Forty-seventh street and Eleventh avenue, New York, in charge of George O'Bierne.

The personnel of the company consists of: Hon. Patrick J. Dolan, of Newark, President; William P. Cubberley, Reeves-Cubberley Engine Co., vice-president; Harry Green, secretary and general counsel; Nat Levy, treasurer; Edward Blau, Newark, director. Albert J. Romer is works manager and chief engineer.

New York Airplane**Show Next March**

NEW YORK, Dec. 29—The trend of American aircraft construction from war models to pleasure, sport and commercial uses will be shown in the second annual Aeronautical Exposition, to be held under the auspices of the Manufacturers' Aircraft Association, Inc., at the Seventy-first Regiment Armory, Thirty-fourth street and Park avenue, New York, in March, 1920.

**BRITISH CONDITION
USED WAR VEHICLES****Huge Slough Plant Turning
Over Thousands of Cars
Each Week**

LONDON, Dec. 11—(Special Correspondence)—Reference to the gigantic and all important repair works set up by the Government at Slough near London has been made in a former note. The scheme it is estimated will cost \$10,000,000 and covers a 600-700 acres site with about 50 acres of new buildings solely used for reconditioning Government trucks, cars and motor cycles.

When the war ended the British War Department owned 62,000 trucks, 28,000 cars and 33,000 motorcycles.

The Government is now busy in getting rid of them or distributing them amongst the services. A visit to Slough this week showed the remarkable progress made since the summer towards completing the workshops, and the vast output there under the direction of Sam Wallace, who was loaned to see the scheme through by the Associated Equipment Co. of London, builders of the London General Omnibus Co.'s buses.

About 240 trucks, an indefinite number of cars and very large numbers of motorcycles are being reconditioned weekly. The bulk is retained for Government use, and the rest sold out for service to the public. New parts are supplied by the makers, and consequently not much machining is called for on the premises. About 250 tons of stores are received daily. About 3,000 vehicles are in constant repair, and there is housing for 1,100 vehicles when finished.

So great is the congestion and hurry for these vehicles, that the shops are being used before completed, and many of them for purposes foreign to what they were designed for. It is anticipated that the whole layout will be finished in less than three months. A steam-electric power plant, of 3,000 kilowatts capacity, is nearing completion; meanwhile power is provided by isolated engines, including some dismantled field army traveling motor workshops. Large though the area of the buildings, all are warmed comfortably by hot air, and all floors are on a common level, being concrete based.

The Slough enterprise was criticised as extravagant and likely to prove "a white elephant" at the outset; it seems like justifying the foresight of its sponsors, and it is already showing a fair return on the outlay. The price paid to the truck makers for the spares for their trucks is an index to what the repairs to the trucks would have cost at their hands. It was partly because of a ramp on this score, which even the Government authorities scented, that the Slough scheme was started.

F. P. O'BRIEN DIES

BOSTON, Dec. 27—Frederick P. O'Brien, who handled the Pierce Arrow cars and trucks at Indianapolis for the past five years, was buried here today. Before going to Indianapolis he was identified with the J. W. Maguire Co., and F. E. Wing, selling first Pierce Arrows and later Marmons. He became one of the best known dealers in Indiana, where he had handled Maxwells and Jeffery cars some years ago. The Bay State A. A. of Boston, of which he was formerly an officer, was represented at the funeral by President Fred T. Moore, Vice-President James T. Sullivan and Frank E. Wing.

Roy D. Hartz has resigned as general salesmanager of the Moreland Motor Truck Co., of Los Angeles.

Hiram M. Browne has resigned as general works manager of the Pan-American Motors Corp., Decatur, Ill.

Ashley P. Peck has been appointed sales engineer and general contract agent of the Christensen Engineering Co., of Milwaukee, manufacturers of Christensen starters. He was formerly with Nash Motors Co., and the Mitchell Motors Co.

William R. Petze, for the past seven years salesmanager of the Prescott Auto Parts Co., manufacturers of piston rings, Webster, Mass., has resigned. His plans for the future are withheld.

W. H. Moseley, Jr., has been appointed a branch manager of the United Motors Service, Inc., of Philadelphia.

Don F. Kennedy has been appointed Michigan distributor for the Townmotor Co., of Cleveland, manufacturers of gasoline industrial tractors.

CLOCK PRICES RISE

WALTHAM, MASS., Dec. 27—The Waltham Watch Co. will make a slight increase Jan. 1 in the list prices of its automobile clocks that have fifteen jewel adjusted movements with winding indicators, effective Jan. 1.

This advance is on present standard models of cases and finish to retail at \$35. Prices will be subject to the 2 per cent cash discount to retailers and jobbers.

This is the first increase on automobile clocks that the Waltham Watch Co. has made—it being impossible to longer maintain the old prices on account of increasing cost of labor and materials.

SHOW REVERE IN CHICAGO

LOGANSPOUT, IND., Dec. 27—The Revere Motor Car Co., of Chicago, A. R. Frampton, president, is locating its salesrooms at 2111 Michigan avenue. Deliveries of cars will commence within ten days. The car will be shown in the Congress Hotel during the Chicago automobile show.

Men of the Industry *Changes in Personnel and Position*

HEADS CINCINNATI ASSN.

CINCINNATI, Dec. 31—John J. Behle has been made manager of the Cincinnati Automotive Trades' Association with offices at 409 First National Bank building. The organization is planning additional activities during the coming year and has several plans for this work well under way.

S. T. Wessell, for ten years with the Buick Motor Co., and since a year ago a member of the staff of the Nash Sales Co., Chicago and Milwaukee, has been promoted to district manager for southwestern Wisconsin, with headquarters at Madison, Wis.

Oakley R. French has left the advertising department of the Goodyear Tire and Rubber Co. at Akron, O., to become a member of the staff of the Russel M. Seeds Co. advertising agency at Indianapolis.

ADOPT VACUUM TREAD

NEW YORK, Dec. 29—The Sterling Tire Corp., Rutherford, N. J., announces that the new Sterling vacuum tread is being adopted for large size tires. Recent tests are said to have shown greater mileage than the bar type.

Expansion of Sterling business on the Pacific coast is indicated in the corporation's announcement that the West Coast Rubber Co. and the Oregon Rubber Co., both of Seattle, have made joint arrangements for the distribution of Sterling tires in the Northwest.

Among other distributors announced are Charles A. Warren, 575 Market street, San Francisco; and George L. Watkins, Birmingham, distributor for Alabama.

CHICAGO SHOW REPEATED

CHICAGO, Dec. 23—The minstrel show and mock trial which was given by the Chicago manufacturers, during the convention of the Automotive Equipment Association, was so good, that it was repeated Monday, Dec. 8, during the meeting of the Automobile Accessory Branch of the National Hardware Association in this city. As usual, Howard E. Patterson, was a bright and shining light, with his work as end man, and as judge in the trial.

ROCHESTER SHOW SET

ROCHESTER, N. Y., Dec. 27—The annual automobile show of the Rochester Automobile Trades Association will be held Feb. 2 to 7 at Exposition Park. Benjamin L. Peer will be show manager.

DESIGNS NEW ENGINE

MILWAUKEE, Dec. 29—Louis Disbrow, noted racing pilot and designer, spent several weeks at Waukesha, Wis., during November and December, supervising the designing and construction of a new engine at the plant of the Waukesha Motor Co., it is learned. Disbrow left for the east shortly before Christmas, at which time the engine was on the block for special tests.

G. Lindstrom has been appointed Bethlehem works manager of the Roller Smith Co., New York, makers of electrical instruments and circuit breakers. Lindstrom is a graduate of the Royal Institute of Technology, Stockholm, Sweden, and has been employed with several electrical instrument concerns.

THE INDEX

YOU will, of course, miss the semi-annual index in this number. If you want one, drop a letter or card to the Editorial Department, AUTOMOTIVE INDUSTRIES, 239 West 39th street, New York City, and one will be forwarded. The reason for the omission is explained on the editorial page.

Maxwell Motor Co., Inc., reports a surplus for the year ended July 31, 1919, after taxes and charges, including reserve of \$600,000 for contingencies, of \$11.64 a share on the \$13,133,342 first preferred stock, compared with a surplus of \$2,292,202, which after 7 per cent on the first preferred, and 6 per cent on the second preferred, left a balance equal to \$5.86 a share on the \$12,805,157 common stock in 1918.

Pierce-Arrow Motor Car Co. earnings in 1919 will not equal those of 1918. Net profits for the year Dec. 31, 1919, will approximate \$2,300,000 after charges and taxes. Deducting preferred dividends of \$800,000, the balance of \$1,500,000 would equal \$6 a share on the 250,000 common shares. In 1918 net profits of \$2,765,741 after taxes and preferred dividends were \$7.86 a share on the common.

White Motor Co. reports a surplus for the first six months of 1919 after taxes of \$1,256,167, equal to \$3.92 a share (par \$50) on the \$16,000,000 stock.

Wire Wheel Corp. of America has declared a dividend of 1 per cent on its 8 per cent stock payable Jan. 10 to stock of record Jan. 2.

DIVIDE PORTLAND SHOW

PORTLAND, ORE., Dec. 27—The automobile show in this city will be divided into two sections, the passenger car show being slated for Feb. 23 to 28 in the Hippodrome building, and the truck show for the same week in the Armory. Both shows will be under the auspices of the Dealers' Motor Car Association, M. O. Wilkins being show manager.

FALLS MOTORS EXPANDS

MILWAUKEE, Dec. 29—The Falls Motors Corp., Sheboygan Falls, Wis., has increased its authorized capital stock from \$2,500,000 to \$4,000,000. The company is incorporated under the laws of Virginia and is the outgrowth of the business originally founded as the Falls Machine Co. It has greatly increased its capacity during the last two years and is contemplating further enlargement of its foundry and machine shops to provide much-needed capacity for manufacturing high-speed gas engines for the passenger car, truck and tractor industries. During the war period the Falls company handled large contracts for Liberty motor parts.

ADD TO BODY PLANT

LANCASTER, PA., Dec. 27—The Lancaster Body Co., successors to the Mack Body Co., will build an addition 120x100 ft. to its present plant. When completed the company will have a plant 120x200 ft. to care for its rapidly increasing business.

FORM EQUIPMENT CO.

NECEDAH, WIS., Dec. 29—The Necedah Mfg. Co. has been organized at Necedah, Wis., with a capital stock of \$100,000 to manufacture automotive equipment of all kinds. Fred Lederer of Milwaukee, a well known engineer and designer of mechanical appliances, is general manager. Other officers are: President, C. C. Fuller; vice-president, H. C. Rattunde; secretary, W. H. Eaton; treasurer, C. T. O'Brien. A plant will be erected at once costing about \$50,000 fully equipped.

CHANGE FIRM TITLE

PHILADELPHIA, Dec. 26—The business of the Manypenny-Scott Co., of 908 North Broad street, distributor of Stearns-Knight cars, hereafter will be conducted by the Scott Motor Co., Inc. Norris A. Scott is president; Autin Boyd, vice-president; Charles A. Bacon, treasurer; Raymond W. Hilles, secretary, and A. G. Billing, service manager.

POSTPONE CONFERENCE

WASHINGTON, Dec. 26—Because of inability of delegates to secure steamship passage, it was announced yesterday by Secretary Glass that the second Pan-American Financial Conference has been postponed from Jan. 12 to 19.

NAMES DISTRIBUTORS

BOSTON, Dec. 27—Mann Motor Car Co., New England distributors of the Maibohm six, announce the appointment of additional distributors in Massachusetts and Maine, as follows:

Brockton, Mass., Allen Garage, P. J. Bulkites, proprietor; New Bedford, Mass., Harvard Garage, A. E. Viera, proprietor; Bangor, Me., Park Garage Co., C. H. Maling, proprietor.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

FORM VALVE MOTOR CO.

MILWAUKEE, Dec. 27—The Balanced Valve Motor Co. has been incorporated in Milwaukee with a capital stock of \$3,000,000 to manufacture a new type of four cylinder engines for automobiles, trucks and tractors. Officers of the company are: W. M. Baumheckel, president; E. R. Menz, vice-president; E. W. Eberhardt, treasurer, and G. E. Pieper, secretary.

EMPLOYS NIGHT SHIFT

MARINETTE, WIS., Dec. 29—The Northern Foundry Co., Marinette, Wis., specializing in gray iron castings for the automotive and agricultural implement industries, has added a full night shift to handle its increasing business. A large contract just accepted calls for 2,000 tons of raw castings for the American Harvester Co. of Minneapolis. Deliveries are spread over a period of about eight months.

INCREASE CAPITALIZATION

RACINE, WIS., Dec. 29—The Racine Auto Tire Co., Racine, Wis., manufacturer of "Horseshoe" tires, has increased its capital stock from \$300,000 to \$1,800,000. The company is increasing its facilities about five-fold by remodeling existing buildings and erecting additions, which will be ready before spring.

FORM FOUNDRY CO.

LA CROSSE, WIS., Dec. 29—The Automotive Foundry Co., of La Crosse, Wis., has been incorporated with an authorized capital stock of \$100,000 and will build a gray iron foundry, 100x150 ft., to be equipped especially to produce castings for the automotive industries. The men behind the new enterprise are C. R. Pieper, Otto M. Schlabach, Harry Dahl and A. J. Roberge, all prominent business men of La Crosse and experienced in the metal-working trades. Ground will be broken for the new shop after Jan. 1.

ROSS PLANT MOVED

CLEVELAND, Dec. 27—The Ross Manufacturing Co. has recently moved into its new plant at 3160 West 106th street. The company specializes in the manufacture of an emery wheel dresser, in the development of which it outgrew its former quarters.

INCORPORATIONS

WILMINGTON, DEL., Dec. 26—The following corporations have been chartered under the laws of Delaware:

Dorris Motors Corp., of Wilmington, with a capital of \$3,000,000, to manufacture automobiles. The incorporators are T. L. Croteau, H. E. Knox and S. E. Dill, all of Wilmington.

DuBois Auto Accessory Co., of DuBois, Pa., with a capital of \$50,000, to deal in automobiles. The incorporators are Frank, John F. and Bernard Ferdinando, all of DuBois.

Andresen Rubber and Manufacturing Co., of Chicago, Ill., with a capital of \$1,200,000, to manufacture tires and automobile equipment. The incorporators are Charles Andresen of Chicago, W. D. Walsh of Clayton, Mo., and Frank Wingfield of St. Louis, Mo.

Allentown Cable & Machine Co., with a capital of \$250,000, to manufacture, assemble, repair and deal in automobiles and engine parts. The incorporators are Albert S. George of Philadelphia and Arthur Frankenhof and Oscar G. Tallman of Allentown, Pa.

SEDGLEY INCORPORATES

PHILADELPHIA, Dec. 27—Announcement is made by R. F. Sedgley of the incorporation of the business conducted under his name, to the R. F. Sedgley, Inc. "Baby" hammerless revolvers and "Hexall" wrenches will be manufactured under that name, under the same management and the same standards as formerly.

ADD \$1,500,000 UNIT

MILWAUKEE, Dec. 29—The building permit issued to the A. O. Smith Corp., of Milwaukee, for the second of a series of large additions to its frame and automotive parts plant calls for an expenditure of \$1,500,000. The second unit will be 360x870 ft., ranging from one to six stories high. The first unit, 170x640, is expected to be ready for occupancy next week.

ERECT AUTO-LOCK PLANT

KENOSHA, WIS., Dec. 29—The Monarch Auto Lock Co., of Kenosha, Wis., has started work on the erection of a complete new plant, to be ready about Feb. 15, and provide a capacity of 500 devices a day. Since its foundation the concern has manufactured safety locks in leased quarters. The device consists of a complete steering wheel, with a lock in the spider, which is substituted for the steering wheel coming as stock equipment of the vehicle.

WESTERN FOUNDRY SOLD

MILWAUKEE, Dec. 29—The Western Rope & Mfg. Co., of Milwaukee and Tulsa, Okla., has disposed of its gray iron foundry at Cedarburg, Wis., to the Chas. H. Stehling Co., 401 Fourth street, Milwaukee, manufacturer of special machinery and equipment. The Western company about two and a half years ago purchased the Schneck Machine Co., Milwaukee, and the Cedarburg Foundry Co. to provide a division for making gas engines for its oil well equipment business.

Calendar

SHOWS

January—New York, International Automobile Mfrs. Congress.

Jan. 3-10—New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce, S. A. Miles, Manager.

Jan. 3-10—New York City, Eighth Coast Artillery Armory, commercial cars and accessories.

Jan. 8—Chicago, Airplanes, Manufacturers Aircraft Association, Congress Hotel.

Jan. 12-17—Dayton, O. Annual Automobile Show, Borchers Auto Co.'s new building, Dayton Auto Trade Assn. H. C. Phelps, Director, and B. J. Borchers, Chairman.

Jan. 13-17—Erie, Pa. Overland-Erie Garage, Erie Automobile Dealer's Association. A. L. Nelson, Manager.

Jan. 17-21—Cleveland, Nineteenth Annual Automobile Show, Cleveland Automobile Mfrs. and Dealers' Assn. Wigmore Coliseum.

Jan. 17-24—Hartford, Conn., Shows, State Armory, Annual Exhibition. Arthur Fifoot, Manager.

Jan. 19-24—Worcester, Mass. Automobile Show, Worcester Automobile Association.

Jan. 19-25—Oakland, Cal. Annual Motor Show, Alameda County Automobile Trade Association, Civic Auditorium. Robert W. Martland, Manager.

Jan. 19-25—Milwaukee, Wis., Auditorium, Annual Motor Exhibition. Milwaukee Automobile Dealers' Inc.

Jan. 22-24—Lancaster, O. Annual Automobile Show, Fairfield County Auto Trades Assn. Sherman Memorial. W. H. Payne, Manager.

Jan. 24-31—Chicago, Ill., Coliseum. Cars: Drexel Pavilion, National Automobile Chamber of Commerce. S. A. Miles, Manager.

Jan. 24-31—Chicago, International Amphitheater, Commercial cars and accessories.

Jan. 31-Feb. 6—Kansas City, Mo. Annual exhibition, Overland Bldg. E. A. Peak, Manager.

Jan. 31-Feb. 7—Minneapolis, Minn. Twin City Automobile Truck, Tractor and Industrial Show, Overland Bldg.

February—Chicago, International Automobile Mfrs. Congress.

February—Deadwood, S. D. Annual Show, Deadwood Business Club. F. R. Baldwin, Manager.

Feb. 2-7—Rochester, N. Y. Rochester Automobile Trades Association, Exposition Park. Benjamin L. Peer, Manager.

Feb. 2-7—Toledo, Ohio. Annual Automobile Show, Terminal Auditorium.

Feb. 3-7—Wilmington, Del. Automobile Show, Hotel duPont.

Feb. 3-7—Baltimore, Md. Automobile Dealers' Assn. Fifth Regiment Armory. John C. O'Brien, Manager.

Feb. 9-13—Charlotte, N. C. Automobile Show, Charlotte Automotive Trade Association. Lee Folger, Chairman, Show Committee.

Feb. 9-14—Cedar Rapids, Ia. Annual Automobile Show, Linn County Motor Trades Bureau, Auditorium. W. J. Hutchings, Chairman, and H. M. Davis, Secretary.

Feb. 9-14—Poughkeepsie, N. Y. Annual Automobile Show, Poughkeepsie Auto Club, Armory. George A. Coleman, Manager.

Feb. 9-14—Salt Lake City. Annual Automobile Show, W. D. Rishel, Manager.

Feb. 9-14—Nashville, Tenn. Nashville Feb. 10-13—Fargo, N. D. Barry Bldg. Fargo-Moorehead Automotive Trade Association. H. L. Wilson, Director.

Feb. 10-15—Quincy, Ill. Annual Automobile Show.

Feb. 14-22—San Antonio, Tex. Automobile Show, San Antonio Automobile Trade Assn. W. A. Williamson, Manager.

Feb. 16-21—Des Moines, Ia. Annual Automobile Show, Des Moines Automobile Dealers' Assn. Ford Factory, Dean Schoeller and C. G. Van Vliet, managing.

Feb. 21-23—San Francisco. Fourth Annual Automobile Show, Exposition Auditorium, Motor Car Dealers' Assn. G. A. Wahlgreen, Manager.

Feb. 21-23—Louisville, Ky. Twelfth annual exhibition, Louisville Automobile Dealers' Assn., First Regiment Armory.

Feb. 23-23—Elmira, N. Y. Elmira State Armory, Elmira Automobile Club. H. S. Bryan, Manager.

Feb. 23-23—Car Show, Hippodrome Building, Dealers' Motor Car Association. M. O. Wilkins, Manager.

Feb. 23-23—Truck Show, Armory, Dealers' Motor Car Association. M. O. Wilkins, Manager.

Feb. 22-23—Ottawa, Ontario. Motor Show.

Feb. 23-23—Grand Rapids, Mich. Motor Car Show, Furniture Exposition Building. M. D. Elgin, Manager.

Feb. 23-23—Duluth, Minn. Automobile Show, Duluth Auto Trades Assn. W. F. Daly, Director.

March—New York, Aeronautical Exposition, Seventy-first Regiment Armory, Manufacturers' Aircraft Association.

Mar. 1-6—Springfield, Mass. Annual Automobile Show, Auditorium, Springfield Automotive Dealers' Assn. Robert H. Clark, Manager.

Mar. 1-6—St. Joseph, Mo. Annual Automobile Show, St. Joseph Automobile Show Assn. Auditorium. John Albus, Manager.

Mar. 1-6—Grand Rapids, Mich. Truck Show, Furniture Exposition Bldg. M. D. Elgin, Manager.

March 1-7—Springfield, Mass. Annual Automobile Show, Springfield Automobile Dealers' Assn. Harry Stacy, Secretary.

March 1-8—Seattle, State Armory, Motor Car Dealers' Association. William J. Coyle, Manager.

Mar. 7-13—Muskegon, Mich. Automobile Show, Muskegon Auto Business Men's Assn. J. C. Fowler, Manager.

Mar. 10-13—Lebanon, Pa. Annual Motor Show, Automotive Trade Association of Lebanon, James Furniture Store Bldg. J. Paul Enck, Manager.

March 12-20—Boston, Mass. Annual Automobile Show, Mechanics' Building.

Mar. 15-20—Great Falls, Mont. Automobile Show, Montana Automobile Distributors' Association.

Mar. 20-27—Trenton, N. J. Annual Automobile Show, Armory, Trenton Automobile Dealers' Assn. John L. Brock, Manager.

Feb. 22-March 6—Birmingham, Eng. British Industries Fair.

March—London, Eng. Motor Boat Marine and Stationary Engine Exhibition.

March—Adelaide, Australia. All Australian Exhibition of motor vehicles, airplanes, engines and automotive equipment.

March 1-15—Lyons, France. Automotive Products, Lyons Industrial Fair.

March 20-27—Pittsburgh, Motor Square Garden, Automotive Association, Inc. John J. Bell, Manager.

April or May—London, Eng. Commercial Vehicle Exhibition, Olympia.

April 3-May 4—Buenos Aires, Exposition of U. S. manufacturers.

July—London, England, International Aircraft Exhibition, Olympia. The Society of British Aircraft Constructors.

TRACTOR SHOWS

Feb. 2-14—Wichita, Kan. Tractor and Farm Machinery Forum, Wichita Thresher-Tractor Club.

Feb. 16-21—Kansas City, Mo. Fifth Annual Kansas City Tractor Club. Guy H. Hall, Manufacturer.

CONTESTS

August, 1920—Paris, France. Grand Prix Race, Sporting Commission Automobile Club of France.

June, 1920—Omaha, Neb., Reliability Truck Tour.

CONVENTIONS

Feb. 9-13—Louisville, Ky. Seventeenth Annual Convention American Road Builders' Assn., Tenth American Good Roads Congress, and Eleventh National Good Roads Show.

May 13-20, 1920—San Francisco. Seventh National Foreign Trade Convention.

S. A. E. MEETINGS

Jan. 6-8—New York. Annual Meeting.

Jan. 13—Chicago. Aeronautic Meeting, auspices Mid-West Section.

Jan. 23—Chicago, Truck and Tractor Meeting, Hotel La Salle.

Feb. 12—Kansas City, Mo. Tractor Dinner, Hotel Baltimore.

FOREIGN SHOWS

January—Glasgow, Scotland. Scottish Motor Exhibition.

February—Manchester, England. North of England Motor Exhibition.

Canadian Court

Interprets "F. O. B."

NEW YORK, Dec. 29—According to the Wall Street Journal, U. S. Consul Johnson, at Kingston, has reported a decision by a Canadian court on the commercial expression "f. o. b." which will be interesting to automobile manufacturers.

The court held that the term "free on board" means that the seller, at his expense, places the goods on the car or vessel which is to carry them from the point specified, and that the buyer takes the risk onward; at the same time the goods must, at destination, be in conformity with the conditions of sale or they may be legally rejected. Further, it is necessary to distinguish delivery from acceptance, for, said the court:

"The carrier is the agent of the purchaser, but his mandate is limited to the transportation of the goods. The question to decide is whether it was the thing sold that was carried from the point of shipment. If the vendor has correctly delivered the thing sold, the buyer becomes the proprietor immediately. If he delivers something else, for instance, if he has sold goods of first quality and delivers goods of second quality—there is no delivery of the thing sold. The buyer can refuse them only when they arrive at their destination."

2500 Machine Tools

in War Dept. Sales

WASHINGTON, Dec. 5—The War Department authorizes publication of the following statement from the office of the director of sales:

The machine tool section, office of the director of sales, war department, has prepared and will distribute to dealers and users of machine tools through the various district selling offices of the War Department, a comprehensive bulletin, listing approximately 2,500 machine tools, valued at about \$4,000,000, which the government is offering for sale.

The machine tools are listed in the bulletin according to their class, type, size and maker, together with the address of the district office having the tool for sale. A brief description of each tool is given including its "service condition."

This bulletin will be revised from time to time as sales are made or as additional machines are declared surplus. It is expected that the revision bulletins will be obtained every 15 days.